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The Geographical Journal

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EXPLORATIONS IN MONGOLIA: A REVIEW OF THE CENTRAL ASIATIC EXPEDITIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

Roy Chapman Andrews, A.M., Sc.D., Leader

The Second "Asia Lecture."

Read at the Meeting of the Society, 8 November 1926.

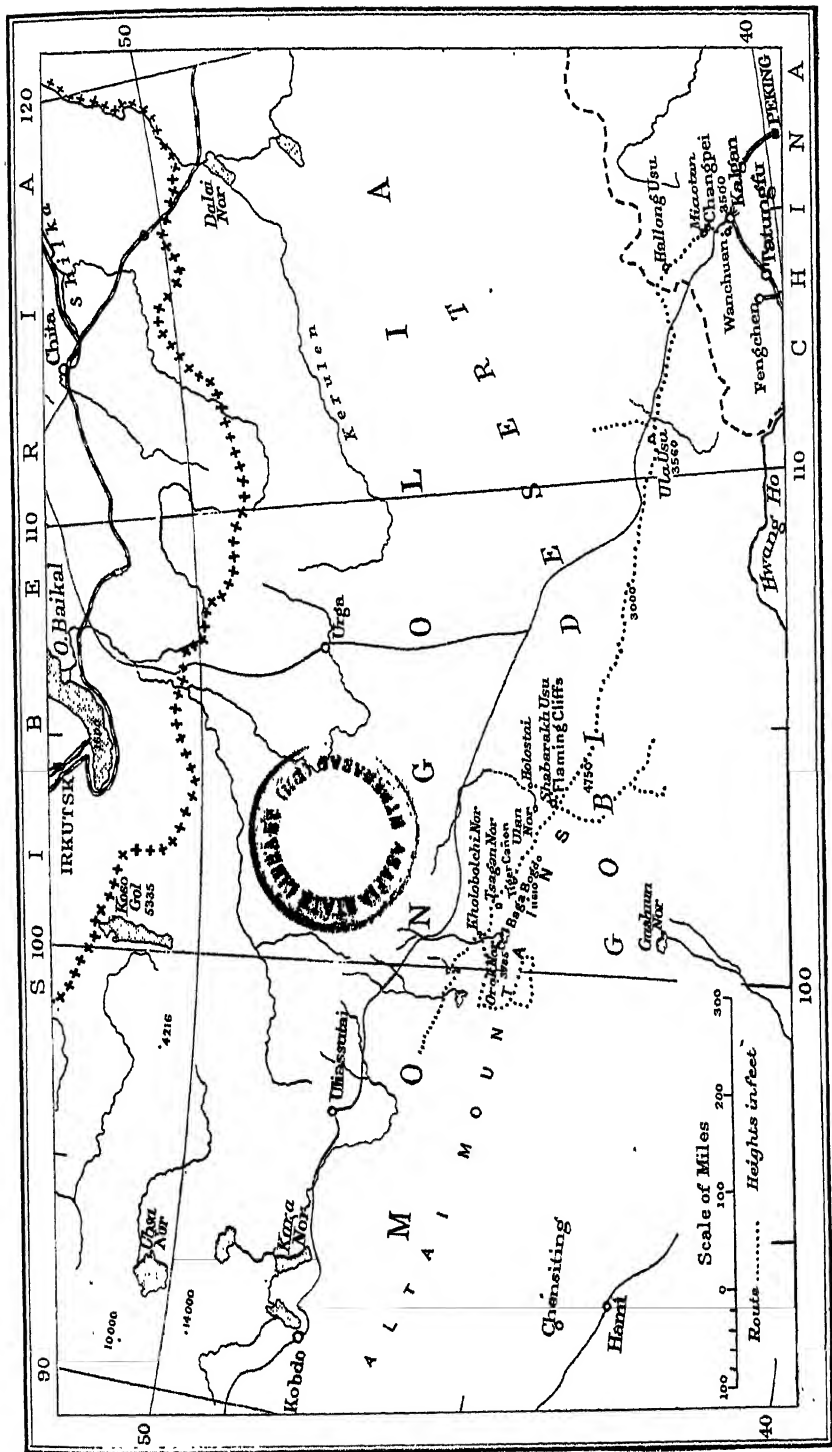
IT is obviously impossible in a single lecture to give an adequate account of our five years' work in Mongolia. I can do no more than present a kaleidoscopic picture of the expedition, touching briefly upon the organization, methods of work, and the most important results in the several branches of science represented.

Twenty-six years ago, Professor Henry Fairfield Osborn, President of the American Museum of Natural History, predicted that the high plateau of Central Asia would prove to be the chief theatre of mammalian evolution and distribution. He believed that there would be found the ancestral types of north mammalian life from which waves radiated to the continents of Europe and North America. But this theory was based almost entirely upon inductive reasoning. He had but few facts at his command.

After ten years of zoological work in various parts of Asia, plans had gradually taken shape in my mind to test the truth of Professor Osborn's theory by reconstructing the physiography, climatic conditions, vegetation, and animal life of the Central Asian plateau in successive geological periods, so far as it was possible to do.

I realized that we could obtain satisfactory results only by bringing to bear upon the problem every branch of science which could assist in its solution. A group of highly trained specialists must be taken in the field *together*. Thus the work of each man could assist all the others.

The value of such correlated work was demonstrated continually. As we sat in the mess tent at night discussing the day's work, it was most interesting to see how puzzling situations in geology would be clarified by the palæontologist; how the topographer brought out important features which gave the key to physiographic difficulties; and how the palæontologist would be assisted by the palæobotanist or geologist in



Sketch-map of Mongolia to show the route of Dr. Andrews' Central Asiatic Expedition

the previous explorers who had crossed the desert with camels only and we were able to do virtually ten years of work in a single season.

Moreover, our expedition has had the somewhat unexpected result of opening Western Mongolia to motor transport. Commerce follows closely upon the heels of exploration, and as soon as we had returned from the first expedition, merchants came to us to ask how they could reach various interior trading stations to bring out valuable cargoes of furs and other commodities. Now there are about one hundred cars running through parts of Mongolia where until we came the only transport was by camel caravan.

We were offered discouragements from the scientific standpoint quite as much as in the use of motors. Our friends called our attention to the fact that, with the single exception of a "rhinoceros" tooth found by Obruchev in 1909, no fossils ever had been discovered in Mongolia. Nevertheless there were reasons to believe that a great deal of the previous work had been too much political or economic and too little scientific. I felt sure that, if we took a group of highly trained experts who had only science in view into the Gobi Desert, results would be forthcoming.

The truth of the prediction was quickly demonstrated. Four days after starting in 1922 we discovered that the main trail between Kalgan and Urga, which has been travelled by thousands of persons, including several geologists, runs directly through three rich fossil beds—one Oligocene, one Eocene, and one Cretaceous. Moreover, the expeditions of 1922, 1923, and 1925 not only substantially verified Osborn's prediction but also "revealed a new volume in the life-history of the Earth."

Although the first two field seasons were primarily devoted to palæontology, the third summer saw the beginning of work in archæology, which will occupy us largely in the future. The theory that Central Asia was the possible home of the Tertiary ancestors of man, namely those of the Eolithic or Dawn-stone Age, holds most alluring prospects for the scientific explorer.

From the inception of the expedition the study of human ancestry has been our ultimate purpose, and the single season's work of 1925 yielded such rich returns that we look forward with increasing eagerness to furthering the explorations.

Organization.

The expedition comprises the following branches of science: palæontology, geology, palæobotany, archæology, topography and zoology, the latter including mammalogy, herpetology, and ichthyology. The 1925 expedition totalled forty men. The foreign staff included twelve Americans and two British; and in the native staff there were twenty-six Chinese and Mongol assistants, some of them being highly trained experts.

I should like to make it clear that the success of our work does not



1. *The Caravan of 125 Camels on its way to the "Flaming Cliffs"*



2. The "Flaming Cliffs," where the Dinosaurs' eggs were found

rest with me as the leader or with any one man. The credit should be equally divided among all the members of the staff, for each man did his work superlatively well. The expedition was a machine which could not have functioned properly unless every part had worked smoothly. I do not believe that a more loyal, efficient, or devoted staff ever has gone into the field on any expedition.

The transport consisted of seven Dodge Bros. motor cars and a supporting caravan of 125 camels. The latter acted as a movable base and with supplies of gasoline and food for five months was sent many weeks in advance of the motor party.

With so many branches of science represented it was highly improbable that all the men could find work in the same place at the same time. Therefore the expedition was divided into four units; each with a car complete with its own driver, interpreter, assistants, and camp gear. Any unit could leave the base camp and maintain itself independently for several weeks if necessary. As a matter of fact, the expedition was almost continually divided, except when we made long marches to new localities.

Our Mongolian explorations have been referred to as a *de luxe* expedition because it provided the maximum of camp comforts. I may say, however, that there was not one item of equipment that did not have a necessary function. We had in the field a group of men who worked at high tension with never a rest for five months. An army cannot fight unless it is well fed. Neither could our men have accomplished what I expected of them unless they were kept physically fit. I do not believe in hardships if they can be avoided, for they lessen effectiveness.

It became evident that if there was to be no loss of time and effort the first season must be strictly a *reconnaissance*. It must make a general survey of many thousands of miles of country to locate and appraise the value for our especial purposes of new regions without attempting exhaustive work in any of them. The next year could then be one of intensive study, and the amount of time to be devoted to each locality carefully planned in advance. Such intensive work would require a different staff from that for rapid *reconnaissance*. As an example, in the summer of 1922 Mr. Walter Granger was the only palæontologist. On the next expedition he was reinforced by three other expert collectors and two highly trained Chinese assistants, because such rich fossil beds had been discovered that we needed a large staff for their rapid exploration. We planned in advance the number of days or weeks that could be devoted to each locality, and with one exception maintained the schedule throughout the summer. This method of *reconnaissance* followed by intensive work is the only effective way to avoid loss of time and effort.

Political Difficulties.

Although the physical difficulties of maintaining a large expedition in such a remote region are great, they become insignificant in comparison with the political obstacles which must be overcome before one can even begin work. Mongolia is a theatre of contending politics, and each year it has been more and more difficult to steer a safe path for the expedition between the political rocks which bar the way to the great open spaces of the Gobi Desert.

The past summer we have not been able to go into the field at all, due to the civil war in China which raged along the Mongolian frontier. It marooned us in Peking, from which we made three ineffectual and highly dangerous attempts to find a way through the fighting lines. We have lost a season's work and many thousands of dollars, but it appears probable that we can get away next summer to continue our explorations in the western Gobi.

Topography.

The existing maps of Mongolia are nearly all based upon the Russian map, which is very unreliable. Apparently much of it was prepared from native information, which is proverbially bad. Mountains appear where there are no mountains. Many of the largest caravan trails are omitted, and important natural features are incorrectly located. As an instance, we camped near Ulan Nor, which is indicated on the Russian map as a large lake. We found that the so-called "large lake" was a small and at that time a dry bed, and that its map position was more than 50 miles in error.

It was evident, therefore, that careful topographical work was a necessity. We were fortunate in obtaining the services of Major L. B. Roberts, U.S.A. R., one of the most expert topographers in America. Major Roberts was assisted by Lieut. F. B. Butler, Corps of Engineers, U.S.A., and Lieut. H. O. Robinson, 1st Loyal North Lancashire Regt.

Major Roberts was confronted with a most difficult problem: to do actual survey work, carrying his levels from a known point, and still maintain touch with the rapidly moving main fleet of motor cars. No man of less energy or initiative could have carried out such a route map successfully. He was offered the usual discouragements, and was told that in a flat country where natural objects were almost non-existent, it was impossible to do a rapid survey. Major Roberts developed the ingenious method of using motor cars as stadia rods. The height of the hub, fender, radiator, and windshield were known, and these points were sufficient when it is realized that the length of sight was from 1 to 2 miles. The distance was taken by speedometer, which had been carefully rated. Regarding the methods of mapping, Lieut. Butler reports substantially as follows:



3. *Wind-eroded red sandstone cliffs on the edge of fossiliferous basin*



4. The sand-dune belt north of the Eastern Altai

"The topographic work done during the field season of the expedition was divided as follows: Route maps were made with plane-table and telescopic alidade; the elevations were carried by vertical angle; the scale used was 1:200,000, and the contour interval was 50 feet. The distance was measured either by stadia or speedometer on the topographer's car. On compass reconnaissances bearings were read with a prismatic compass, and elevations were determined by aneroid barometer. Distance was measured by speedometer.

"In area surveys the scale used was 1:20,000, and the contour interval was 1, 10, and 20 feet.

"The most important piece of work undertaken by the topographic party was the execution of a route survey of the entire season's journey. It was necessary that this survey should be based on an established datum, and consequently efforts were made to carry the line and levels from the Kalgan railroad station. This was accomplished in the face of certain difficulties. Before the rest of the party took the field, the topographers had run the line up and over the pass which breaks from China on to the Mongolian plateau, and had reached a point 36 miles beyond Kalgan. Barometers were not used on the main route survey at any time during the season, and this survey is the first to be made in the area covered, wherein an attempt was made to carry line levels. For the first part of the work, the run of 36 miles from Kalgan to Miaotan on the plateau, stadia rods were used.

"For the route work, Major Roberts decided to use a plane-table and Gurley telescopic alidade. The Baldwin solar chart was depended upon for orientation, and the compass resorted to only on the infrequent occasions when clouds obscured the sun.

"To enable us to cover the day's run and at the same time not to reduce the anticipated rate of travel, two other cars were detailed to work in conjunction with the topographers, and were used as stadia rods on foresight and backsight stations. While the backsight was being taken on one of these cars, the other would run on and pick up a point for foresight. The backsight having been completed, the rear car would be signalled, run forward, and, while the foresight was being taken pass us and be ready in turn to establish a foresight. The average day's run with this system was 58 miles, and the maximum 73.4 miles. A total of 1040 miles of such line was mapped.

"The levels were carried by the table itself, and in many of the set-ups we had level readings. Usually, it was possible to step the vertical difference with the stadia hairs, and only rarely was recourse had to the Beaman arc. Distance was taken from the speedometer on the topographer's car, which had been carefully rated prior to taking the field. During the field work it was checked against courses, from 15 to 20 miles long, which had been laid out by stadia. The use of the speedometer in measuring the distance was more or less an experiment, but the

manner in which the traverse closed in on the control points fully justified the confidence in its use.

"Naturally, since the differences in elevation were frequently a function of the distance run, the question of the accuracy and suitability of the speedometer distance was one of double importance. In certain instances, where the nature of the ground was such as to cause an excessive error to arise from the use of the speedometer, the strip would be crossed by using the stadia. Sights as long as 25 miles were used in locating mountains and other features adjacent to the line.

"To one who has not worked with this or similar methods, the value of such a reconnaissance no doubt seems questionable. The results of this year's work prove the system sound, however, and possible of wide development. In addition to the check afforded by closure or control points, there were interesting opportunities to intersect on distant prominent mountain peaks from various points. The invariable small triangle of error was a constant check on distance and orientation of the baseline. In addition to barometer comparisons, a check on line-levels was afforded by vertical angles read to these peaks from various stations along the route when possible.

"The second type of route reconnaissance by compass was not controlled save by closure on the starting-point. These reconnaissances over large areas, however, and the data obtained, will be valuable in revising and expanding such maps of Mongolia as exist.

"On this type of reconnaissance no field sketches were made, but full notes were kept, together with detailed remarks, and the sketch was worked up upon the return to the base camp. The total lineal distance covered by this method is over 950 miles.

"The area surveys, four in number, represent type formations. They will be of considerable value as text-book studies, and two of them will, in addition, be of great importance in showing the setting of valuable palæontological discoveries. In this series of maps is included one made near Hallong Usu of typical ridge and vale topography in the grassland belt. The second sheet, made at Ula Usu, shows upland and badland escarpment topography developed on later sediments, including typical wind-scour hollows on the peneplane. The third sheet, made at Shabarakh Usu, shows typical upland and escarpment with local badland development and a sand-obstructed valley. The fourth sheet, made at Tsagan Nor, shows a typical desert lake with several well-defined ancient beach-lines marking successive stages in a long history of fluctuating levels. These area surveys were all done by stadia. No control was laid out save in the case of the largest sheet, the lake survey. In this instance the present shoreline was triangulated and flagged. Incidentally, in making this sheet 1-foot contours were used to determine accurately ancient lake-levels. The four sheets mentioned above totalled 78 square miles of area survey.

"Latitude was determined by observation of Polaris off the meridian, the hour-angle computed, and correction applied. For time and longitude, the equal-altitude method was used, both sun and stars being observed. We carried with us three Hamilton chronometers: one was a No. 950 (watch movement), and two were torpedo-boat type clocks. It had been hoped to have radio service as we went along, but this was impossible once we were in Outer Mongolia and under the control of the Mongolia Government. Naturally, therefore, time, upon which all the locations ultimately depended, was a weak factor. Travelling in motor cars as we did, and covering the distance in a day that we had to, with cross-country going all the way, the chronometers were subjected to frightful conditions. To offset all this, however, certain stations were occupied for long stretches at a time, and the rating of the clocks could be determined by observation over these periods.

"Likewise, on the run back many of the original stations could be reoccupied after even a longer stretch of time, so that excellent field ratings were obtained. From the last of such observation to the final check-in and rating upon the return to Peking a minimum of time elapsed, so that the over-all and intermediate rate has been established accurately. The error, as computed from the rates determined in the field, coincided in a gratifying manner with the compared error as found by radio check in Peking. The rate for the three-week period following our return made a smooth curve with the plotted field rates.

"Several times each day magnetic north was plotted on the route field sheet, the solar chart being used to establish the meridian. Establishing meridian in such a way was sufficiently accurate to be commensurate with the compass needle used. It is interesting to note that the Eastern Hemisphere agonic line was crossed. Much local attraction was detected and many reversals recorded, all of which made us appreciate the solar chart as our most valuable aid.

"An instrument that gave excellent results was the so-called 'Swedish Barometer' (Paulin System). We found it much better than the ordinary aneroid."

Palæontology.

Since the main object of the expedition was to test the theory of Central Asia as the chief theatre of mammalian evolution and distribution, palæontology assumed the most important rôle in our work during the seasons 1922-1923. In 1925 archæology was strongly emphasized, and it will divide the honours with palæontology in future expeditions.

I shall not attempt even to review the many important palæontological discoveries, but will present only a brief summary of the broader aspects of our work. Professor Osborn has remarked that "these discoveries have established Mongolia as a treasure-house of the life-history of the Earth from the close of the Jurassic time onward to the close of the

Pleistocene time, *revealing especially the hitherto unknown high continental life of Cretaceous and Tertiary times*. Consequently the outstanding geologic discovery of the expedition is, first, that Gobi since Jurassic time has been a central Asiatic continent extremely favourable to the evolution of reptiles, mammals, insects, and plants hitherto known only along the Cretaceous shorelines of Europe and the Cretaceous sea-borders of the centre of America; and, second, that this now terribly desert region, traversed by the gazelle and the wild ass, was certainly luxuriant with life throughout Cretaceous and Tertiary time, sparsely forested, with limited rain supply like the high-plateau regions of Africa to-day.

"These upland conditions of Mesozoic and Cænozoic time, also favourable to the origin of the human race itself, led to the further generalization by the writer on returning from Iren Dabasu in 1923, that the ancestors of man occupied this region during Cænozoic time and are likely to demonstrate the central Asiatic theory of human origin.

"The expeditions, . . . encircling in 1922, 1923, and 1925 the entire Gobi district in a 3000-mile radius, discovered no less than 23 distinct geological formations extending downwards from Lower Pleistocene time into Lower Cretaceous and Upper Jurassic."

The palæontological work of the expedition "revealed the high central Asiatic plateau as the home of most of the terrestrial dinosaurian reptiles of Upper Jurassic and of Cretaceous time. In brief, these discoveries establish Mongolia as a chief centre of northern terrestrial life-history from the close of Jurassic time onwards to the very close of Pleistocene time."

Of the several thousand fossil specimens obtained by the expedition the seven Cretaceous mammal skulls found at Shabarakh Usu certainly are among the most important from the standpoint of pure science. Drs. W. K. Gregory and C. G. Simpson, who have just completed an exhaustive study of the tiny skulls, conclude that

(1) The Palæocene and Eocene insectivores and oxycænid Creodonts, taken collectively, represent survivors of an earlier insectivore-creodont stock, examples of which have now been discovered in Mongolia.

(2) The discovery of these earliest of definite placental mammals in Mongolia furnishes some support of the hypothesis that Central Asia was the homeland of the radiation of the placental mammals as of a higher class than the marsupials and monotremes.

(3) The Mongolian Cretaceous mammals stand between the Jurassic pantotherians and the Palæocene placentals, both in time and in dental structure, but are somewhat nearer to the latter.

The discovery of the now famous dinosaur eggs created a surprising popular interest in the expedition. Also from the same sand-swept dinosaurian breeding-grounds of Middle Cretaceous time some seventy-five beautifully preserved skulls and fourteen skeletons of the ancestral



5. Alluvial fan on north slope of Eastern Altai, and peak Boga Bogdo on right at head of "Tiger Canyon"



6. From the slopes of Baga Bogdo, looking across mouth of the Canyon to Tsagan Nor

Protoceratops were removed. These present an unrivalled series showing every stage of growth and development from the newly hatched baby dinosaur to old adults.

The skull and parts of the skeleton of the giant *Baluchitherium* is one of our most spectacular discoveries. However, the magnificent series of Titanotheres and the ancestral types of the Pecora, Rhinoceroses, Notungulates, Rodents, and Carnivora must rank as equally important if of less popular interest. As Professor Osborn has remarked :

“The scientific staff of the expedition, between the years 1922 and 1925, has interpreted one of the most desert regions of the entire world with the twin sciences Palæontology and Geology, and the wilderness of Mongolia now blossoms forth with its glorious story of prehistoric life, as the homeland of the greater number of known terrestrial vertebrates.”

Archæology.

For many years the theory that Asia was the region in which mankind originated has been held by the most eminent authorities. But with the continued discovery of primitive human or anthropoid types in Europe and to a less extent in Africa a tendency has developed to regard either of these two countries as a possible homeland for the human race.

There is not time nor is this the place in which to review or discuss the evidence for or against these various hypotheses. In every case the matter is still one of theory. There are not sufficient connected facts to warrant definite statements. If the problem is ever solved it can only be by continued exploration throughout the world.

The expedition under my leadership is endeavouring to do its bit in this great work by devoting its energies to the high plateau of Central Asia. However, we are not trying to *prove* this region to be the home of primitive man. We are testing a theory and have approached the question with open minds in a scientific spirit. To discover the truth is our only object.

Although the Central Asian plateau is indicated as the place of man's origin by a mass of theoretical evidence, it is only in the last decade that systematic work in the realm of prehistoric archæology has been undertaken there. It is a vast region, difficult of access, and it is doubtful if it can ever be as thoroughly explored archæologically as is Europe to-day.

Nevertheless, rich results have rewarded the very beginning of its investigation. In 1923, the Jesuits Père Teilhard de Chardin and Père Licent discovered abundant evidences of Palæolithic man in extensive deposits of Mousterian implements at three different localities on the edge of the Ordos desert. Previous to this, Dr. J. G. Andersson had traced a widespread Neolithic and pre-Chinese culture in various parts of China proper.

Our own work was first conducted in the Gobi Desert of Central Mongolia and was in the nature of a reconnaissance. In this paper I should like to present a brief review of what we have found.

Because caves and rock shelters, such as are abundantly present in Europe, are virtually non-existent in Mongolia, archæological work there is particularly difficult. Nevertheless, almost everywhere along the 1000 miles of the expedition's route from near Kalgan to the outlying ranges of the Altai Mountains we discovered more or less superficial traces of one or two prehistoric cultures. In sight of the Altai, where workable artifact materials such as jasper, chalcedony, and agate were abundant, evidences of long-standing occupation became more and more apparent.

Mr. Nelson, our archæologist, reports in substance as follows: The bulk of the archæological remains still lay scattered for the most part on the geologically ancient land surfaces, out of which they could not have weathered; but the types of things occurring were sufficiently differentiated to be distinguished as belonging to a succession of cultural horizons, some of which had ranged practically over the entire territory covered by the expedition. Yet in seven widely separated localities, the remains of two of these cultures, deeply embedded in old stratified wind deposits, were discovered.

In attempting to differentiate the data, there is no choice at present but to follow the European systems of classification and terminology. All told, five cultural horizons, not including the living Mongols, were found in the Gobi Desert and its borders. I will describe them briefly, proceeding from the recent to the most ancient.

Metallic.—In the grasslands of North Central Mongolia as well as in certain parts of the desert monuments consisting of rectangular and circular rock enclosures, from 3 to 150 feet across, are fairly numerous. Investigation proved most of these to be burial-places. Near these graves and obviously associated with them we frequently discovered pictographs pecked on the face of the rock. These are easily recognized as delineations of human beings, camels, horses, and cattle, as well as stag, antelope, ibex, and mountain sheep, some of which game animals are now absent from certain of the localities under consideration.

Petroglyphs of this type usually belong to the Stone Age; yet there were never any stone artifacts lying about near either the rock pictures or the burial structures. Although we dug into several graves and found skeletal remains of a brachycephalic people, nothing but bones was discovered until the end of the summer. Then a grave was opened in which lay a skeleton with its head upon a saddle, strangely like the American army saddle known as the McClellan; also there were bows and arrows tipped with iron, bits of fabric, and iron saddle trimmings. The meagre data we obtained do not warrant any precise conclusions about this interesting culture. It seems probable, however, that it is an expansion of the remarkable mound culture of Bronze and Iron Age



7. Looking south towards Boga Bogdo in cloud, from the mouth of "Tiger Canyon"



8. *The home of the Dune Dwellers near "Flaming Cliffs"*

times uncovered by Russian investigation in the Upper Yenesei country. As such its Mongolian antiquity can scarcely exceed 2000 years.

Neolithic and Mesolithic.—Last summer a great culture-camp probably of Azilian-Campignian time was found just north of the eastern extension of the Altai Mountains, within half a mile of the spot where the dinosaur eggs were first discovered in 1923. In fact, these primitive artisans used for necklace ornaments the broken shells of dinosaur eggs as well as those of *Struthiolithus*, the giant ostrich of the Stone Age of Mongolia. No human fossils have been found thus far, but the fact is established that the Stone Age tribes spread over the borders of the Gobi Desert region during the Ice Age, establishing their workshop near the large lakes bordering the Altai Mountains. These Neolithic and Mesolithic people have been named by Mr. Nelson the "Dune Dwellers," or the "Shabarakh culture," because of the occurrence in old dead and indurated sand deposits called by our geologists the "Shabarakh formation." It yields a combination of traits which appear to be distinctly Gobian.

The Neolithic stage is superimposed upon the Mesolithic, and is an outgrowth of it with certain additions and modifications. Chief among these are the occurrence of spear-heads, arrow-points, and pottery, grey or brick-red, with string-marked, incised, or geometric patterns. No spear or arrow heads or pottery occur in the definitely pre-Neolithic horizon which precedes it.

The Mesolithic stratum is characterized by hammerstones, cores or nuclei, flakes, perforators, scrapers, and disk-beads of dinosaur and *Struthiolithus* egg-shell. The chipped stone (mostly red jasper) artifacts in several specific details conform closely to the Azilian flint industry of Western Europe. We found at the Shabarakh locality literally thousands of flint artifacts and flakes both upon the surface and deeply embedded in the formation itself.

There were definite indications that this had been a favourite camping-place for many thousands of years. The geologists are certain that a lake had existed, probably intermittently, in this great basin, furnishing water for the inhabitants of its shores. Moreover, 36 miles to the west we discovered the source of supply for the flint of which the primitive artisans made their artifacts. That this culture was widespread is evident, for at nearly every place where the Shabarakh formation appeared, artifacts were present.

Upper Palæolithic.—In two localities on old erosion surfaces composed of Quaternary gravels, stone implements of Mousterian and Aurignacian types were found. Although they were not actually *in situ*, there was sufficient evidence to make us believe that they may have weathered out of the formations.

Eolithic.—This dawn stage of man's handiwork appears to be well represented in a number of places in Mongolia, especially in the region of

Orok Nor. Here on an old erosion surface composed of Quaternary gravels lie thousands of fractured rock and pebbles, more or less weathered but showing successive stages of flaking. A number of these splintered pieces assume artificial form and character even to the extent of now and then showing the bulb of percussion. In addition, nearly all of them exhibit more or less retouched margins, a succession of chips having been removed much after the manner of true Mousterian technique. Yet the obviously varying ages of the chip beds leave no doubt that the specimens are the veritable products of natural forces still at work.

I must admit that Mr. Nelson takes very little stock in eoliths as a whole and those of Mongolia in particular. After walking for some miles behind our caravan when they were passing over a peneplane strewn with jasper rocks and large pebbles, he came to the conclusion that a camel with its feet could assist nature in making just as good eoliths as could primitive man with his hands. Rocks were broken and flaked by the weight of these heavy animals in a way which imitated most remarkably the eolithic technique. After his experiences in Mongolia, I believe I am correct in stating that Mr. Nelson would regard suspiciously the finest eolith that ever has been discovered.

I should like to make a few remarks by way of summary of the archaeological work. Our chief contribution has been the discovery that primitive human beings at various periods during the Stone Age did inhabit the Gobi Desert, that they were lake-shore and river-shore dwellers, and that they wandered over an extensive area. Their cultures resemble corresponding cultures of Europe in so many respects that it appears to be probable that they were derived from a common source. Whether or not this is true it is impossible to say at present, for there is not sufficient data upon which to base positive statements.

Palæobotany.

After the 1922 and 1923 expeditions the need of a botanist was felt by all the scientific staff. The climate, rainfall, and general conditions of vegetation are most clearly indicated by the fossil plant record. What such a record would show and how it would check with the evidences furnished by palæontology and geology was of vital importance in the study of our general problem.

Dr. Ralph Chaney, a member of the staff of the Carnegie Institution of Washington, D.C., was kindly detailed to the expedition by Director J. C. Merriam. Although Dr. Chaney's interests were chiefly concerned with palæobotany, he made a collection of some five hundred living plants which are now being studied and described.

Dr. Chaney found that the fossil plant record of the Tertiary, as we had suspected, was largely confined to silicified wood because of the comparatively dry climate of Mongolia during very early times. Nevertheless,

the specimens which we obtained give a most illuminating picture of climatic conditions during the Cretaceous and Tertiary and confirm the story already told by geology and palæontology.

Dr. Chaney reports as follows :

" A comparison between the climatic conditions of Mongolia and that portion of China lying immediately to the south during the Cretaceous and Tertiary periods brings out the fact that the relative difference in rainfall which now exists between these two areas has probably extended far back into geologic times. The northern provinces of China now have a rainfall of between 20 and 25 inches annually, which falls mostly during the summer in connection with the monsoon winds. These winds do not reach Mongolia because of the intervening Khingan Mountains and other ranges which run across Northern China ; the rainfall there is only a few inches a year, and the trees are scattered or absent. On the basis of the fossil record, it may be suggested that these mountains have been in existence through the Tertiary and back into the Cretaceous period, during which time a sequoia forest whose moisture requirements were about 40 inches a year occupied their windward side ; on the north slopes, semi-arid and arid conditions not greatly unlike those of to-day appear to have existed, limiting the trees to conifers and poplars, and preventing the growth of any extensive forests.

" The living trees of Northern China and Japan are of special interest because of the similarity of the leaves of certain species to those of fossil species in the Tertiary of Western America. A species of hawthorn, *Crataegus pinnatifida*, has leaves which closely resemble those of the fossil *C. newberryi* of Eastern Oregon, and there is no living American species which shows a like relationship. One of the common elms of Northern China, *Ulmus parvifolia*, is much like a fossil elm from Eastern Oregon which has no near relative, either living or fossil, in America.

" Interesting enough, the Sequoia which is now limited to Western America is found fossil in Manchuria. We therefore have the situation of certain kinds of trees which occur in America as fossils but no longer live there, although they are present to-day in the forests of Asia ; and there are others which, though now extinct, are shown by the fossil record to have lived there in the Tertiary, and which survive in the living forests of America."

Geology.

The Geological work of the expedition carried on by Professors Charles P. Berkey and F. K. Morris has yielded most important results. In fact, they are so varied and far-reaching that it is difficult to summarize them in a few words. However, Dr. Berkey writes, as follows :

" If we were called upon to state a few of the most outstanding results achieved by the geological investigation, we would choose the following :

" 1. The geologic column, as summarized in the two tables. No such

detailed and systematic statement has been possible hitherto. Many of the formational units, several of the major erosion intervals and periods of diastrophism, as well as much of the correlation, are presented for the first time.

"2. The recognition of the nature of the great Mongolian bathylith—one of the largest units of the kind thus far recorded. This is important, not only to "pure science," but it supports a very practical inference of far-reaching importance, namely, that valuable mineral deposits are more likely to be found about the margins of the bathylith than in the area of broad exposure. So far as the mineral resources of Mongolia, Southern Siberia, China, and Manchuria are known, this inference is supported.

"3. The reading of the history of climatic changes. The climatic history thus far offered by the expedition is the most extensive effort of its kind yet attempted in Central Asia. The results achieved by Huntingdon in his study of the climatic changes of Pleistocene and Recent time in other parts of Asia are supported by our results.

"It is not possible to work out a sequence of events that applies to all Central Asia from the Jurassic period to the present, and that gives an especial significance to the stratigraphic column and the palæontologic history of the region. These studies of past climates have an important bearing also on the habitability of Central Asia during the period of human evolution."

The Central Asiatic Expedition to the present time has differentiated and defined fifteen formations in the so-called later sediments alone, and an equal or greater number of formations in the ancient floor, whose succession and approximate age are satisfactorily determined.

Zoology.

In this science investigations were confined to mammalogy, herpetology, and ichthyology, with the exception of small collections of birds.

The Asiatic Expeditions in China proper and Mongolia have brought to the American Museum of Natural History, 9900 mammals, 11,666 reptiles and batrachians, and 10,000 fish. These are now being actively studied and many papers already have been issued. Many new and important facts regarding the relationships and probable derivation of European and American living types are being demonstrated by these vast collections.

Future Explorations.

The three seasons' field work already completed have been confined to Outer Mongolia, north of the Altai Mountains. We feel that *for the purposes of the expedition*, this region is now sufficiently well known to warrant directing our attention elsewhere. A surveyed line more than 1000 miles long has been run north-west through the heart of the desert, thus giving accurate starting-points for any future topographic work.

We hope in the seasons of 1927, 1928, and 1929 to carry on similar investigations in Inner Mongolia. We are particularly anxious to complete another westward surveyed route south of the Altai which will connect with the excellent work done by Carruthers, Stein, and other explorers in Chinese Turkestan. To carry out such a survey will be one of the main objects of the expedition in 1927. We have reason to believe that rich sedimentary fossil-bearing basins lie in the Western Gobi, and that special attention to prehistoric archæology will be eminently worth while.

Publication of Results.

Seventy preliminary papers have been published in the *Novitates* and *Bulletin* of the American Museum of Natural History. These put on record very briefly some of the most outstanding discoveries of the expedition. Fourteen volumes of scientific results have been projected. Volume 2, on the Geology of Mongolia by Professors Berkey and Morris, is now in Press. Volume 3, also on Geology, is in course of preparation. Volume 4, on the Invertebrate Palæontology by Dr. A. W. Grabau, has nearly been completed.

The maps made by Major Roberts in 1925 have just issued from the Press.

Other final volumes on zoology and botany are in an advanced stage of preparation.

The cost of publishing the scientific results in a way commensurate with their importance is enormous. Since this expense must all be met by the funds of the expedition, the leader has had an infinitely more arduous task in providing its finances than in directing its field work.

Notes on the Photographs reproduced.

The first shows the expedition's caravan of 125 camels on its way to the "Flaming Cliffs." This is a view typical of Gobi topography, the desert floor being of decomposed rock rather than of sand. Because of this rock floor it was possible for the expedition to use motor cars. Great peneplane surfaces very nearly flat extend in some regions for many miles. The desert vegetation consists of short wiry grass, camel sage, and low thorny bushes. A very little rain will cause the entire surface of the desert to change in an almost miraculous manner: where there had appeared to be nearly dry yellow gravel, within a few hours the surface will be tinged with delicate green, showing how quickly the desert vegetation responds to water.

The second plate shows the "Flaming Cliffs," where the dinosaur eggs were discovered.

We have here an edge of a great basin eroded out of the Gobi peneplane which sweeps northward in an almost level floor from the Altai Mountains 30 miles to the south. The cliffs, which stand in grotesque forms beautifully sculptured by wind and frost and rain, are of brick-red

stone. These sedimentary basins, eroded largely by wind action, are a feature of the Gobi. In these sedimentary basins the expedition finds its fossils; in the grass lands north of the desert the strata are largely granite graywackes and other hard rock which are unfossiliferous.

The third plate gives another view of the great "bad land" basin in which the dinosaur eggs are discovered. The step-like formation is produced by wind erosion of the red sandstone. The red cliffs contrast strongly with the yellow sediment of the basin floor, which is largely coarse sand.

Tsagan Nor lies 20 miles from the base of the Altai. Between it and the mountains is a belt of sand-dunes nearly 100 miles in length, but only 2 or 3 miles in width. The dunes are composed of the finest sand, which is blown by the wind like spray from the crest of a wave. Most of the formations are of the typical barkan type, but change their shape continually with the direction of the wind. These sand-dunes are found on the southern or western shores of almost every desert lake, and even in the dune areas water is close to the surface. Quite often we were able to dig a well with our hands, having only to scoop out 4 or 5 feet of sand for water gradually to fill the depression. Clumps of long coarse grass and a beautiful bush sweet-pea growing 4 or 5 feet in height are usually found in the valleys between the shifting dunes.

The fifth plate shows the eastern Altai Mountains with the peak Boga Bogdo in the background. This peak, which rises about 12,000 feet above sea-level, had not, so far as I am aware, been climbed until it was ascended by members of the Central Asiatic Expedition in 1925. Except for a few weeks in August, the summit is usually covered with a blanket of snow. In the foreground is one of the great alluvial fans which are striking features of the eastern Altai. This particular fan was 10 miles long, and had its apex 2000 feet above the level of the plain. The fans are the *débris* washed out of the great canyons formed by the torrential rains which continually fall upon the higher peaks of the eastern Altai. Most of the fans are covered with a thin blanket of short grass, as are the slopes of the mountains themselves.

The view over the valley of Tsagan Nor, from a point below the peak of Boga Bogdo, shows in the distance, about 15 miles away, a wind-eroded escarpment, between which and the lake is an area of shifting sand-dunes. In the dry river-bed a grove of elm trees follows the line of the old watercourse.

This gives an excellent idea of the elm trees which grow in the dry river-bed. The only places in the Gobi in which we found trees were in a few river bottoms. There are no young trees among them; all show considerable age, indicating that new growth has not started for many years. In the eastern Altai Mountains themselves there were no trees of any sort: the slopes are either bare or covered with short grass.

The seventh plate is taken looking south toward the peak of Boga

Bogdo, which is nearly obscured by clouds, from the mouth of Tiger Canyon. Members of our party attempted the ascent of Boga Bogdo from the mouth of the Canyon, but found that it was impossible to reach the summit from this side. A fairly easy route, however, exists on the western slope.

The last plate shows the home of the dune dwellers. This is an area of old dead sand-dunes which have been formed around the roots of tamarisk trees. Erosion has carved valleys through the dunes, exposing great numbers of flint implements which were made by people who lived on the shores of an ancient lake. This great culture site is only a mile from the Flaming Cliffs where the dinosaur eggs were found. Indeed, we discovered bits of dinosaur egg and ostrich egg shell which had been drilled by these primitive people to make necklace ornaments.

The results of the surveys of this expedition, carried out by Major L. B. Roberts and his assistants as described in the paper, are well shown on 28 sheets of maps, copies of which have been presented to the Society by Dr. Andrews. They are as follows:

(1) Traverse, plotted on 19 sheets, of the route of the expedition from Kalgan westward for 865 miles, through Hallong Usu, Ula Usu, Shabarakh Usu, and Tsagan Nor to near Kholobolchi Nor, about 240 miles south-east of Uliassutai. This map is on the scale of 1/200,000, and shows approximate contours in brown at 50 feet vertical interval in the neighbourhood of the route. At the bottom of each sheet is a vertical section of the part of the route it contains.

(2) Vicinity of Hallong Usu, scale 1/20,000. Approximate contours at 20 feet vertical interval.

(3) Vicinity of Ula Usu, scale 1/20,000. Approximate contours at 20 feet vertical interval.

(4) Djadokata Fossil Field and Shabarakh Usu Artifact Area, scale 1/20,000. Approximate contours at 20 feet vertical interval.

(5) Vicinity of Tsagan Nor, scale 1/20,000. Approximate contours at 10 feet vertical interval. This map shows the water-line of the lake on 10 June 1925, and as it was in 1922.

(6) Five black-and-white sketch-maps of routes extending from the main route of the expedition, on scales varying from 1/400,000 to 1/825,000:

- (a) North from Shabarakh Usu to Holostai in Suma. (b) West from Kholobolchi Nor. (c) North from Ula Usu. (d) South from Shabarakh Usu. (e) South across the Altai Mountains from Kholobolchi Nor.

These routes vary in length from about 40 to 250 miles.

The routes of the expedition are shown on the sketch-map accompanying this paper, and it will be seen that they cross parts of the Gobi desert to a great extent previously unexplored.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: We inaugurate our session under happy auspices—we begin it this year, as two years ago, with the Asia lecture; that is to say, a lecture founded by Mr. Dixon, a Fellow, who gave the Society a sum of money to promote lectures every two years upon the continent of Asia. The first of these was delivered by that great authority

so well known to us all, Sir Aurel Stein, and many here will recall the massive and masterly exposition of mediæval Asiatic history which he then gave. To-night we are going to another part of Asia, and we call upon an authority no less distinguished than Sir Aurel Stein to tell us about it. Dr. Roy Chapman Andrews, who is Curator in Chief of the Department of Asiatic Exploration in the great Museum of Natural History of New York, has spent, I believe, five seasons in Mongolia. He comes here with the widest of reputations, for what he found in Mongolia has become known to the whole civilized world. The discovery of the dinosaur eggs alone would have sufficed to make him notorious and remembered. But he is going to tell us to-night about a great deal more than dinosaur eggs: about the organization of almost a new form of exploration—the realization of what I ventured in my presidential address a few months ago to hope would be the work in the future of this Society—that is, intensive study of a particular area. With that extraordinary thoroughness, and I must also say with those great means which are at the disposal of Americans, he was able to concentrate upon one great but defined area the resources of almost every kind of science; and although it is practically impossible for Dr. Andrews in the short time at his disposal this evening to put before you anything but the merest outlines of the results of so large and well run an expedition, he will at any rate try to give you some idea of the organization that such exploration entails. This is, therefore, a very notable moment in the history of the Society; it is about to hear what the exploration of the future is to be. The great journeys of exploration are probably done in almost all the world; the great pioneer lines have been thrown across the continents. What we have to do now is to fill up great gaps between those single lines. Dr. Roy Chapman Andrews is going to show you how this has been done in a most interesting region, Mongolia. I call upon him to give you such account as he is able to do in the time available of this fertile and now famous exploration.

Dr. Andrews then read the paper printed above, and a discussion followed.

Sir FRANCIS YOUNGHUSBAND: I am all with the President and with the lecturer as to the necessity of intensive exploration of comparatively small areas, but I hope you will realize that it is somewhat embarrassing to the unfortunate traveller who many years ago have made a trail across one of those small areas when an army of experts comes along with a well-organized expedition, and descends upon a little point in that trail and focusses attention upon it. A day or two ago I had the great pleasure of meeting Dr. Andrews, and before a quarter of an hour had passed he showed me on the map where he had struck my trail of 1887, and asked me if in the course of that journey across the Gobi I had seen any likely places for dinosaur eggs! I ran my mental eye along the 1200 miles of the Gobi that I had passed through and asked myself, "Now, can I honestly say that at that particular place you could be dead certain to find dinosaur eggs in hundreds?" I could not do it. But I have this afternoon handed over to Dr. Andrews the actual diary which I kept at the time, though I hope that, as I was then only twenty-three years old, he will be lenient with my very poor observations. In spite of the embarrassing questions previous travellers are asked, it is delightful to hear a lecture such as that delivered by Dr. Andrews this evening, and to see the beautiful photographs of the Gobi. That is an enormous satisfaction to me because I had no camera with me, and until this day I have never seen any picture of the country I passed through. We are too accustomed in this Society to have placed on the screen dreadful dull grey photographs, but Dr. Andrews has brought us

coloured pictures which have given us a most delightful impression of the desert. And a desert is not the barren kind of affair we are inclined to think it; it has plenty of colour about it. Dr. Andrews has spoken of the sunsets in particular, and he claims that they are the finest seen anywhere in the world. I should like to corroborate that, for I have a vivid recollection of the sunsets in the Gobi. I used to start on my day's journey at five o'clock in the evening and go straight at the sunset, travelling until one or two o'clock in the morning. An indelible impression has been left upon me of the magnificence of these desert sunsets.

I should like to add that an expedition such as that described cannot be carried out unless the leader has great organizing capacity. He has, first of all, to spend a year or two in organizing the whole expedition. That in itself is an enormous undertaking: getting the men and money together, as well as the whole of the supplies. And then one can realize what it must have been in the field to coordinate motor cars and camels. When I crossed the desert motor cars had not been thought of. To get Americans, British, Mongols, Chinese, and Heaven knows who else to work together requires in the leader magnificent capacity for organization. And what the lecturer said is perfectly true. Every leader feels that he cannot carry out what he has to do without the men working under him—that he is indebted to them for a great part of the success of the expedition. But success is not due to them entirely. In the main, the success of the expedition must depend upon the leader himself. We can gather from what the lecturer has said and from the way in which he spoke of his men that he is an ideal leader of an expedition. And we in this Society ought thoroughly to realize that.

In conclusion, I should like to say that we must admire also the pluck which Dr. Andrews has shown this evening. He underwent an operation upon his eye only last Friday; he was in bed until a couple of hours ago, but he came here to give us this lecture, and he has given it in a thoroughly manly, delightful, and humorous way. It has been a pleasure to listen to him, and we congratulate him most sincerely upon the success of the expedition, and wish him even further success on the final part which he will carry out next year.

Prof. D. M. S. WATSON (Professor of Zoology, University College): As a palæontologist it gives me the greatest pleasure to have the opportunity of speaking after the address Dr. Andrews has given. The expedition he has designed and conducted is without parallel in the history of palæontological science. In the course of three or four years he has brought our knowledge of the history of life in Mongolia from literally and absolutely nothing, except one rhinoceros tooth, to a stage which in the United States of America, which is parallel in size and complexity, was reached only after thirty or forty years of investigation, not by a single authority but by many museums and by the Survey. I do not think anywhere there is any other piece of geological work carried out on the scale of a whole continent, as it were, which has given us at once the history of a large area throughout the whole of Jurassic, Cretaceous, and Tertiary times. Not only have we now this geological knowledge, but we have also revealed to us new and most important types of animals, particularly those little mammals recently described by Drs. Gregory and Simpson, which came from the same beds as the dinosaur eggs, which will, I am sure, prove to be of the utmost importance.

Apart from such finds of interesting creatures, we have the fact that there has been verification of many—not of all—of the conclusions which President Osborn drew from his studies of the distribution of mammals of the world.

We have verification of the idea that Mongolia was one of the great centres, if not the greatest of all centres, of the evolution of mammals, and that gives great satisfaction to those actually working on palæontological material. To have one's convictions verified is the test of the value of one's type of scientific work. For that we have to thank Dr. Andrews. We have also to thank him for providing us with a perfect model of the way in which such palæontological expeditions should be worked. We have had investigations carried out in the field by those men who will work out the results in the laboratory, and this for all the sciences which are capable of throwing light on the problems to whose solution the expedition has been directed.

Dr. F. W. THOMAS (Librarian, India Office): The Royal Asiatic Society doubtless has a profound interest in the subjects dealt with in Dr. Andrews' lecture, but probably with its present limitations that interest will become keener in proportion as the subject-matter approaches prehistoric times. On behalf of that Society I may, however, say that Dr. Andrews' lecture has fully fulfilled the keen anticipations with which it was awaited. He has shown himself a master, not only of the organization of expeditions, but also of the exposition of the results of an expedition.

We have not heard much from Dr. Andrews concerning the present Mongolians, but there is a Mongolian history in which a full description of them is given, and I have also read that there is a certain Mongolian superstition which stands in the way of research in that country. It is thought that certain operations may result in carrying away the luck of the country. I am afraid Dr. Andrews' expedition has deprived Mongolia of a good portion of its luck. And I should like to point out that there are in Mongolia many persons who could have told Dr. Andrews the whole story from beginning to end, namely, the reincarnate Lamas who are said to have lived through all the stages recorded in the results of the expedition! If Dr. Andrews had sought the permission of the Lama of Urga to remove the bones of one of the dinosaurs the Grand Lama might have replied that it was a long time since he used those bones!

Sir SIDNEY F. HARMER (Director, Natural History Museum): There is only one possible reason why I could have been asked to address any words to you this evening. Dr. Andrews represents one of the great centres of science in the United States; he comes from the American Museum of Natural History, and I, on my part, have the honour of representing an institution of a similar character on this side of the Atlantic. It is perhaps fitting that I should be asked to say two or three words just to explain the admiration that his colleagues on this side of the Atlantic feel for the great work Dr. Andrews has been carrying out in Mongolia. The British Museum and the American Museum of Natural History have a great deal in common. I am not going to indulge in the unprofitable task of comparing their relative importance. I would rather say that we are thoroughly united in our main objects, one of which is the search for scientific truth. Dr. Andrews has already explained that in going to Mongolia he was actuated by the desire to find out what is true and not to prove any theory. That is the real spirit which actuates science in general, at any rate any which is worthy of the name. We have followed with the greatest admiration the work that Dr. Andrews has done. You will agree, from what he has told you, that he has thoroughly deserved success. I think the account he has given of the practical way in which the expedition was carried out is extraordinarily instructive. We have very much to learn on this side of the Atlantic from what our American brothers have been doing.

I have therefore merely to say that I should like on behalf of all representatives, as far as I am entitled to speak for them, of geological and allied sciences in this country, to express our cordial congratulations to Dr. Andrews for the great work that he has done and to emphasize the fact that the work really is great. The American expedition has discovered an enormous amount which we did not know before; an enormous amount of the sort of information we are especially anxious to have. I have only one little piece of regret with regard to the expedition—that it has taken Dr. Andrews away from the study of whales, a group in which I am myself specially interested, and on which he seemed to be rapidly becoming the principal authority when I first had the pleasure of making his acquaintance some fourteen or fifteen years ago. If any of you wish to find an instructive and extremely interesting account of whales, I should recommend you to consult a little book Dr. Andrews published some years ago called 'Whale Hunting with Gun and Camera.' In the whaling expert you will hardly recognize the explorer of Central Asia, except that he shows now the same qualities of ability, perseverance, and success of which he gave evidence before. I have great pleasure in congratulating Dr. Andrews on the splendid results he has achieved.

The PRESIDENT: The speeches to which you have listened since Dr. Andrews' lecture have been one succession of votes of thanks, and it is not necessary for me to move anything more formal. Dr. Andrews may rest assured that we are most grateful to him, and appreciate enormously his courtesy in coming specially from New York in order to speak to us to-night; that we are particularly appreciative of the fact, which Sir Francis Young-husband revealed, that Dr. Andrews has been none too well since he landed in this country; and that he has pulled himself out of bed in order to keep with you the engagement which he has so magnificently fulfilled. Incidentally, he has proved the peculiar virulence of the London climate; for I believe Dr. Andrews spent five seasons in Mongolia without suffering from any such infirmity as fell upon him after three days in London. We must all wish him every conceivable success in the years to come. He was unable to go to Mongolia this last year owing to the Chinese Civil War. We must hope that next season, at any rate, the Chinese Civil War will shift to some other part of China, and not interfere with the prosecution of his great expedition.

I do not know that I have ever listened to any lecture which gave me such a sense of reserve of information and reserve of power. There was an enormous amount more that we should like to have heard and which I, for one, would gladly have listened to for many more hours. I should like, for example, to have heard more about the forest region of Mongolia which Dr. Andrews mentioned at the beginning of his lecture. He did not actually take us to Urga or show us anything to illustrate it. No doubt when he comes again, as we hope he will, he may talk to us about a different part of Mongolia, and show us different landscapes. They can not be more attractive or interesting than those he has shown; but they will be different. I am sure you will express with the utmost cordiality your sense of what Dr. Andrews has done for you this evening.

THE EAST ANGLIAN COAST

J. A. Steers

Read at the Afternoon Meeting of the Society, 15 November 1926.

1. Introduction.

THIS paper deals with the coastline from Hunstanton to the Orwell-Stour estuary (*i.e.* the East Anglian shore *sensu stricto*). Along this stretch great changes have taken place in historic times and many excellent examples of shore phenomena occur. The detailed study of many parts yet remains to be completed. Observations are still being made on Scolt Head Island and Blakeney Point which, it is hoped, will yield valuable information for future work. Meantime some interesting features on both the Norfolk and the Suffolk coasts, which the writer has studied in some detail during the past four years, may afford a sufficient basis for a general paper. The whole of the East Anglian shoreline is a well-known example of a submerged low coast. This submergence took place in all probability in Neolithic times. At the completion of the process the coast must have been extremely irregular, especially in Suffolk and Essex. Evidence for this submergence is found in the numerous drowned valleys and occasional submerged forests, as that at Brancaster. In the course of time marine erosion cut back the promontories, and longshore currents, passing along the coast, carried the material worn away from the promontories and deposited it across the estuaries. In this way rivers were either deflected by a shingle and sand spit or else completely dammed. Concurrent with this marine deposition the very fine particles carried by the streams were deposited on the inner side of the spits and bars. The origin of the Norfolk Broads is of this nature.*

To-day casual inspection of any map of East Anglia shows that the coast of the southern part of Suffolk and Essex is much more indented than that of Norfolk and Northern Suffolk. This may be explained either by one or other of the two following causes, or by a combination of both.

1. The submergence may have been in the nature of a tilt, so that Essex was depressed more than Norfolk and Suffolk.

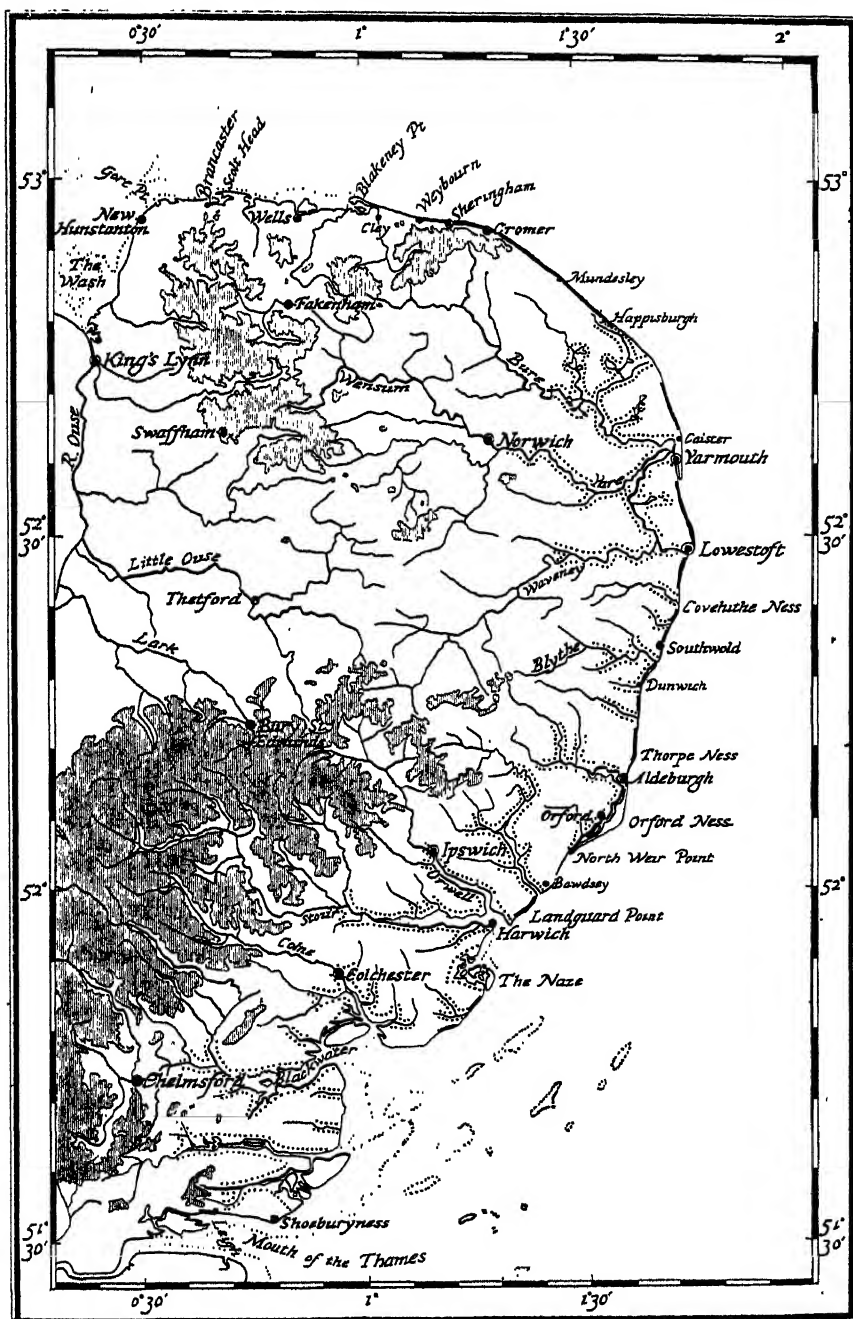
2. The shingle and sand along this coast, at any rate east and south of Sheringham, travel to the south. It follows that the more northern irregularities would be the first to be smoothed out.

Certainly there is much less shingle along the coast south of Landguard Point, at the mouth of the Orwell, than north of it.

It is with these spits and bars that this paper is more particularly * concerned.

Geologically the area is one of soft, non-resistant strata. At Hun-

* Gregory, *Nat. Sci.*, vol. 1, 1892, pp. 347-355.



1. Sketch-map of EAST ANGLIA. The drowned valleys are shown diagrammatically by dotted lines, and cliffs by heavy lines

stanton, facing the Wash, the cliffs are formed mainly of chalk. The gradual eastward dip of the chalk brings it below sea-level near Sheringham, where it is succeeded by Tertiary deposits. Covering both chalk and Tertiaries are glacial beds—sands, gravels, eskers, etc. It is highly probable that these beds are the source of much of the shingle along the coast. The chalk can be traced as a ridge just within the flat marshlands all the way from Hunstanton to Blakeney, and even to Weybourn. This ridge is an old sea-cliff and presumably formed the shoreline at the conclusion of the Neolithic submergence. Hence, on the Norfolk coast there has been time since that period for the accumulation of vast sand flats, shingle spits, and marshes. The evolution of these spits is traced later. Marshland ceases abruptly at Weybourn. From here, as far as the Thurne River, there is a more or less unbroken line of cliffs of varying height and of fairly uniform softness. These cliffs are suffering very marked erosion, as testified by measurements at Cromer and elsewhere. Between Sheringham and Weybourn there are one or two gaps, dry valleys, in the cliffs, which are comparable to the "Vallées" of the Chalk Cliffs of Normandy.* Between Happisburgh and Yarmouth is the Broadland proper. Flat fenland areas, separated from the sea only by shingle bars, perhaps capped by sand-dunes, alternate with short lines of cliff. These cliffs cease at Caister, and give place to the formerly wide estuary of the Bure-Waveney river system. From Gorleston southwards lines of cliff and estuaries, wholly or partially blocked by shingle spits, alternate in fairly regular sequence, in some cases the spits attaining great size, as at Orford.

2. Travel of Beach Material: The North Norfolk Coast.

Along the east coast of England it is generally accepted that beach material is moved southwards by longshore currents. While this is true of much of the coast, it by no means holds good for all. A great deal of detailed work is still necessary before one can formulate any precise notions of the local currents and their effects between the Wash and Sheringham. At Sheringham† the breakwaters cause shingle to pile up on their western sides, pointing to an eastward drift. But there is an unbroken line of shingle from Sheringham westward to the end of Blakeney Point. This headland has quite definitely grown to the west, and is still doing so. It appears, then, that there is a reversal of movement somewhere near Weybourn. In his book, 'The Sea Coast,' Wheeler gives a map showing his general view of the tidal currents along the east coast of England. The southward-moving water from the Lincolnshire coast bifurcates near Sheringham, and a sort of eddy current is shown running westward from near that place.

* De Martonne, "Traité de Géographie Physique," 4th ed., pp. 976 *et seq.*, and Plate XVIII.

† 'Royal Commission on Coast Erosion,' vol. 1, Pt. I., 1907. First Report. Minutes of Evidence, 2517-2520 (C. Reid), 2672 (C. Reid), 4148 (W. H. Wheeler).

Whilst it is probable that such an eddy does exist, it does not seem to be just in the position Wheeler gives it. From his map it looks as if Blakeney Point has been formed largely under its influence. This is not so. If a table (see below) is made showing the times of high water at various parts on the Norfolk coast, it shows that high water is later both east and west from a place near Wells Bar. This suggests that the bifurcation (if it exists) shown by Wheeler's map takes place near Wells, the water moving east and west from there.

						H. W F. and C.*
Hunstanton	..	..	..	..	..	6'25
Thornham	..	..	..	..	..	6'23
Brancaster	..	..	..	..	..	6'22
Burnham	..	..	..	..	..	6'21
Wells Bar	..	..	..	..	..	6'20
Stiffkey	..	..	..	..	..	6'29
Blakeney Bar	..	..	..	..	..	6'30
Cromer	..	..	..	..	..	6'70

In order to make sure if such an eddy as Wheeler shows had any influence on Blakeney Point a considerable number of observations, some extending over a period of about twelve hours, were made off the Hood (see Fig. 2) at Blakeney. Similar observations were also made at Scolt Head. The method usually adopted was to note the drift of floats. Bottles which were almost completely submerged were used, because the effect of winds on them was comparatively small and had no appreciable influence on the direction in which the bottle drifted. In order to obtain a rough idea of the speed at which the bottle moved, each observation was timed over a length of 100 to 200 feet. As the tide rose or fell sandbanks were gradually submerged or uncovered, and at times it was impossible to make an observation because the float could not be thrown clear of the waves breaking on the banks. However, after making allowance for this, the results obtained were tolerably uniform and showed very clearly the direction of drift.†

The evidence derived from these observations, and from several others based on similar data obtained in 1925 and 1926, is strengthened by a statement made in writing to the author by the officer in charge of the now disbanded Coast Guard Station at Morston: "The tide moves off the Hood and Marams close inshore, *easterly* up to two hours after high water with an inset to south-east, and two to two and a half hours after top of flood up to three hours on flood (the tide runs in a) *westerly* (direction)." These facts seem to prove quite definitely that no such current as Wheeler's map shows exists actually alongshore at Blakeney.

* See Admiralty Chart 108 (1924). Further information was obtained from H.M. Coastguard, Brancaster Staithes.

† At Scolt other observations were made with anchored glass floats. These gave similar results, but were not quite so satisfactory.

There is another factor of considerable importance in the effect of tides which is sometimes overlooked. The direction of tidal drift is well known to change with ebb and flow, but at the same time there is a difference, often considerable, in the level of the water, so that material worked on at high water is quite distinct from that worked on at low water. In other words, there may be two distinct and opposed movements of beach material on the same foreshore. To some extent this appears to be the case between Hunstanton and Sheringham, but how far it is so it is at present impossible to say, on account of the many irregular channels along the coast. But what is particularly noticeable is that in several cases the entrance to a harbour shows a double deflection. In the case of Blakeney, for example, the shingle, which lies above and quite distinct from the sand, has pushed westward and caused a deflection of the harbour mouth in that direction. Since the shingle is usually high on the beach, it follows that it is only worked on at high water. On the other hand, the sand at the lower level has deflected the mouth eastwards.* The shingle is the more important factor, but the effect of the sand cannot be ignored, although it is more than probable that the wanderings of the channel in the sand are related to changes in wind direction, the effects of storms, and other factors which can hardly be reduced to a constant law. Similar cases occur all along this part of the coast: in each of them the shingle shows a westward movement, the sand sometimes westward, sometimes eastward.†

If, then, the shingle spits have grown in a direction not always in conformity with the tidal currents, some other explanation than that generally accepted is demanded. Before a final decision can be made, a much greater number of observations are necessary.‡ But two factors appear to bear directly on the matter. Along the whole of the East Anglian coast the prevalent winds are south-west or south-south-west. These are not the dominant winds. The dominant winds come from the quarter between north and east, and blow over the greatest fetch of open water; hence they can generate larger waves, which cause material to move westward by beach-drifting.

When these latter winds blow, following a period of north-west and north-north-west winds, and when they coincide with a spring tide, the greatest amount of damage is done on the East Coast. The level of the water is then higher than usual, and in a north-east storm the shingle banks, dunes, and soft cliffs offer but little resistance. In this way much material is prepared for redistribution, and is partly redistributed. The second point is the possible effect of the prevalent south-west and south-south-west winds. These are in number much in excess of winds from

* It should be noted that the harbour entrance is very variable.

† I am indebted to Dr. Vaughan Cornish for certain suggestions in this connection.

‡ Mr. Chestney is now making long-period observations at Scolt Head, which, it is hoped, will help to solve this problem.

any other quarter, and together with calms make up more than half the total winds for the year. They blow off shore and oblique to the shore. The tendency of an off-shore wind is to cause a bottom current toward the shore in the contrary direction to the wind itself. Assuming this to be the case, the under-current should come from the north-east or north-north-east. These winds are "normal" winds for the most part, and not necessarily connected with storms. They may perhaps be responsible for a certain amount of westward drifting.* The beaches are "combed down" when winds are from a northerly quarter, and "make" when the winds are from a southerly quarter. Storms from the north or north-east cut away the beach, and the material thus dragged down is later built up in normal times. Whether the undertow due to the north or north-east winds carries material directly out to sea is debatable. Theoretically it should do so, but in the case under discussion the water as a whole is very shallow, and under the impulse of a strong wind and a storm from the north-north-east or north-east it is not improbable that the whole body of water in the immediate proximity of the breakers would have a westward motion.

A point which is of some interest here is that it is noticed frequently that in calm and moderate weather with winds from any direction, the waves approach from the quarter between north and east. A particular case may be instructive. On 19 September 1926, a particularly fine day with a very calm sea, the wind all day blew from the land, freshening at times to a moderate breeze. Throughout this period quite small waves were coming in from the north-north-east, and the writer noticed shingle being moved westward by the breaking waves whilst the tidal current was running eastwards—and a little outwards within 50 yards of the shore. Such waves may be the product of wind conditions far out in the North Sea: the waves travel on long after the impulse has ceased, and cause the westward beach-drifting.

3. Blakeney Point and Scolt Head Island.

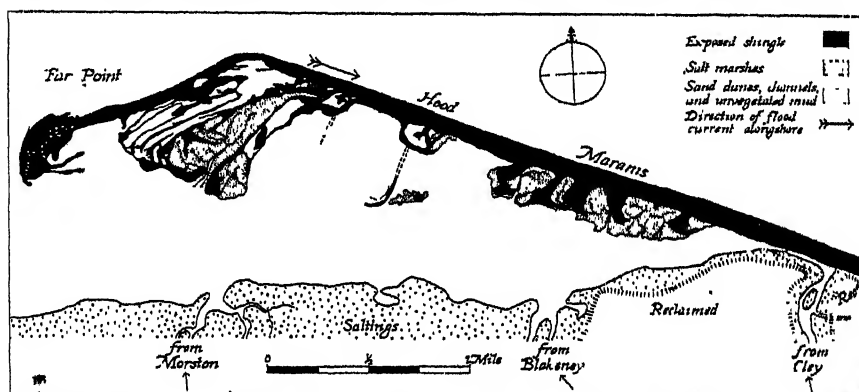
Reference has already been made to Scolt Head and to Blakeney Point. They are the two principal shingle and dune headlands of this part of the coast. Blakeney Spit begins at Weybourn and runs westward for about 8 or 9 miles. At its westward end it has many backward bending ridges, most of which are covered with sand-dunes. New additions are constantly being made to the Far Point. These new beaches have been called apposition beaches (*vide* Description of Blakeney Point in chap. xii., 'Tidal Lands,' Carey and Oliver, 1918).† The main

* See also below.

† See also several papers in the *Journal of the Norfolk and Norwich Naturalists' Society*, and the following Blakeney Point publications: No. 4, 'Blakeney Point, Norfolk. The New Nature Reserve,' F. W. Oliver; No. 7, 'Topography and Vegetation of Blakeney Point, Norfolk,' F. W. Oliver and E. J. Salisbury; No. 11, 'The Structure and Water Content of Shingle Beaches,' T. G. Hill and J. H. Hanley;

beach is now being rolled steadily landward: the motion is virtually that of a moving sand-dune, though much slower. Along its inner side are frequent recurved ridges. These occur in clumps, as at the Marams and Hood. It is more than probable that the ridges at the Marams and Hood are merely of greater magnitude than those which formed constantly as the spit grew. These smaller ridges have been quite obliterated by the landward travel of the whole spit. The dunes are a secondary feature, being formed on the shingle ridges.

Scolt Head is now an island. The eastern entrance to the channel in rear is Burnham Harbour. There is not much doubt that this is really a break-through, due to the ponding back of the water in the channel at a high tide, which caused it to push through at a weak point in the spit.* Such a ponding back of the water could take place quite easily as the result of powerful north-west or west-north-west winds acting with a high spring tide. Similar phenomena are known at Orford (*q.v.*).



2. Development of Blakeney Point, after F. W. Oliver, 'Trans. Norf. and Norwich Nat. Soc.', vol. xi. pt. v., 1923-24

The general trend of the island is continued directly in a dune-covered shingle ridge east of Burnham Harbour and within the present main dune ridge there. This latter ridge has grown a good deal in comparatively recent times. Viewed from the north-west extremity of Gun Hill Ridge (a high dune near the harbour mouth) the impression that both island

Blakeney Point Reports, 1913, 1914, 1915-1916, 1917-1919, 1920-1923, in vols. of same years in *Norf. and Norwich Nat. Soc.*; F. W. Oliver, "Scolt Head and Blakeney Point," *Norf. and Norwich Nat. Soc.*, xi—Pt. 5, 1923-1924.

* For further evidence on this point see F. W. Oliver, "Scolt Head and Blakeney Point," *Norf. and Norwich Nat. Soc.*, 1923-24, pp. 573-4. At the eastern end of Scolt Head Island is an *Aster* marsh, which, in the time sequence, is out of place, but which may be accounted for as an older marsh which was rejuvenated when the break-through occurred.

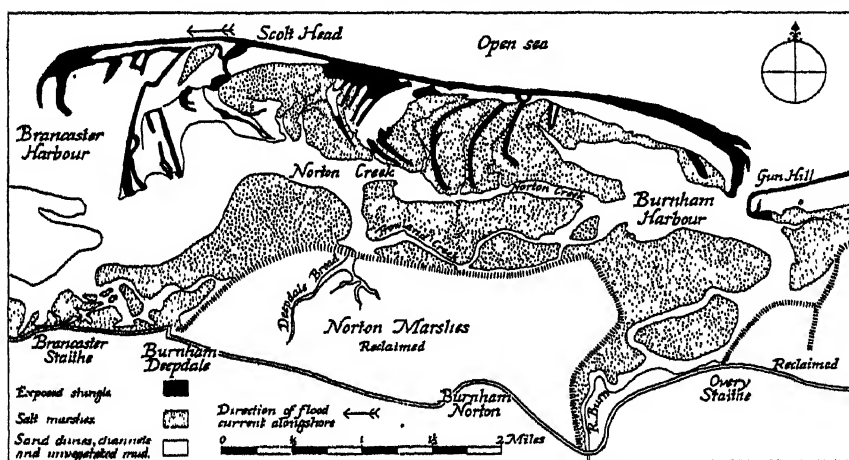
See also F. C. Deighton and A. R. Clapham, "The Vegetation of Scolt Head Island: A Preliminary Account," *Norf. and Norwich Nat. Soc.*, vol. 21, pt. i., 1924-25, pp. 86-111.

and dune ridge east of the harbour once formed one and the same feature is greatly strengthened.

The writer is at present engaged on some detailed work on Scolt Head Island, but one or two general points may be of interest here.

This island, like Blakeney Point, has been growing westwards rapidly in recent years. Some measurements made in 1925 showed that between the years 1886 and 1904 the average annual growth was about 283 feet. Between 1904 and 1925 the annual progression apparently dropped to an average amount of 150 feet. These measurements were made from the 6-inch maps of 1886 (published 1891), 1904 (published 1907), and a plane-table survey made by a party of botanists in 1925.* With this very rapid westward growth there has been a corresponding landward movement of the main beach.

Throughout the length of the island there are numerous examples



3. Structure of Scolt Head Island in 1907, adapted from F. W. Oliver, *loc. cit.*

of long recurved ridges. These do not show any particular grouping, except that they are rather more numerous along the western half of the island. A marked characteristic of these recurved ridges—and those of Blakeney as well—is their great length. Frequently they themselves show secondary recurving, sometimes in very complex fashion. Both Scolt and Blakeney have grown westwards by successive additions of these recurved ridges at their western extremities. In both cases many of the ridges are now dune covered.

In one important respect Scolt differs from Blakeney. At this latter

* Steers, "Scolt Head," *Norf. and Norwich Nat. Soc.*, vol. 12, 1924-25, pp. 84-86; and also vol. 12, 1926-27. Further mapping was carried out by O. D. Kendall in 1926; his results confirm the figures given above (*Norf. and Norwich Nat. Soc.*, vol. 12, 1926-27).

place it has been shown that the flood current close inshore is running in opposition to the growth of the main beach. This is not the case at Scolt. Similar observations were made here, and the movement of the tidal currents close inshore may be summarized thus: With a rising tide the water is moving westwards and the turn takes place about the time of high water.*

At Scolt, then, the flood current is running with the shingle, and may possibly aid in its transportation. However, the action of waves is almost certainly the main factor. Assuming this to be the case, both Scolt and Blakeney owe their origin to beach drifting by wave action. The swash of a wave when breaking drives up material of all sizes in the direction of approach: when the wave retreats some of this material is left stranded; the remainder returns directly seawards under the force of gravity. Thus the various particles and pebbles describe parabolic paths, and gradually shift westwards with the dominant waves. A few experiments made with marked pebbles at Scolt and Blakeney bore out these facts very well.†

4. Summary of the North Norfolk Coast.

There are many other features of great interest along this stretch of coast, e.g. Gore Point, near Holme, another shingle spit subject to very violent and rapid changes ‡; and the unprotected marshlands at Warham and Stiffkey, but further details must be suppressed to keep the paper within reasonable limits.

In summarizing the recent history of this part of the coast, the sequence of events seems to have been:

1. The land was depressed in Neolithic times, and the chalk cliff, now inside the marshes, was formed.
2. The general drift down the east coast of England has been responsible for the vast accumulations of sand which underlie the marshes and extend many miles out to sea.
3. The sorting action of the waves has, to a considerable extent,

* One other small point may be noted. Along the main beaches at Blakeney and Scolt there are often to be seen many shallow channels between low sandbanks and the beach. These sometimes upset the normal run of the water when they are only partly filled. Their presence can hardly have any real effect on the beach, inasmuch as they are very local and transitory.

† Although evidence points to the waves being the dominating factor in beach drifting at both Scolt and Blakeney, the tidal currents may have a secondary effect. This is probably the case at flood and ebb, when heavy waves churn up the sand and shingle off shore. Some of the material so disturbed must be acted upon by the tidal currents and carried along in intermittent suspension. It is almost impossible to demonstrate this action, and it is only likely to take place outside the line of breakers. Shoreward of that line material can be acted upon only by the waves. As the offshore zone along all this stretch of coast is very shallow, wave effects must be felt down to the bottom well off shore.

‡ A. S. Marsh, *Journal of Ecology*, vol. 3, 1915, pp. 65-93.

separated the shingle from the sand, and the shingle is now built up into long spits and bars.*

4. With the growth of these spits and bars, salt marshes gradually began to form on their landward side, and later land has been reclaimed by man.

5. The accumulation of the sand and the effect of the bars in breaking up the evenness of the coast have caused a growing complexity in the tidal currents, and these again are much influenced by the Wash.

6. After the formation of the shingle bars, sand-dunes were formed on them by wind action over the great sand flats which are exposed and partly dried at low tide.

7. Vegetation has helped in the fixation of shingle and dunes, and many of these forms are now stable.

8. Although accretion is in excess of erosion along most of this coast, the shingle bars are all gradually being rolled landward over the marshes by wave action.

Clement Reid † suggested that this stretch of coast marks a former river-bed, a river which flowed eastwards from the Wash to the Rhine. There are certain gravels within the marshes, as at Cley, which may perhaps point to river action, but very little is known of them. The fact that marsh mud is found outside the main beach at Weybourn seems to the writer to be evidence more in favour of the landward rolling of the beach as a whole than of a former river channel. Further, the chalk cliff does not resemble anything so much as a former sea-cliff, from which the sea has retired by means of constructing shingle bars on the shallow off-shore bottom by its own action.

5. Sheringham to Lowestoft : Lowestoft Ness.

Eastwards from Sheringham there appears to be nothing abnormal in the travel of beach material : shingle and sand are in constant transit to east and south. Occasionally, in big storms, the beach may, in places, be quite denuded of shingle and the underlying clay (marsh mud for the most part) exposed. However, in normal times the beach is once again replenished. Along all this part (Sheringham to Caister) erosion is predominant, and past records show how greatly the sea has encroached on the land. Apart from the damming back of small streams, such as the Thurne, and the formation of broads,‡ there is nothing of any great interest on this part of the coast in so far as the present paper is concerned.

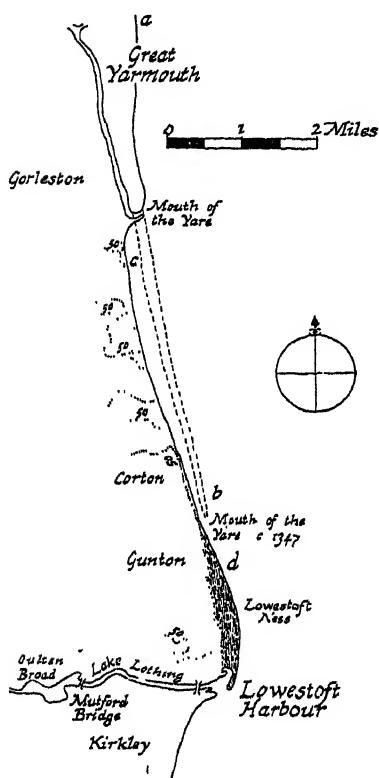
Of Yarmouth a brief *résumé* of coastal changes during historic times is necessary in order to introduce a suggestion for the formation of

* It is a point of some interest whether some of these shingle bars are of the nature of true offshore bars rather than spits formed wholly by longitudinal accretion.

† *Vide* 'Mins. of Evidence of Royal Commission on Afforestation and Coast Erosion, 1907,' Appendix xii. pp. 163-172.

‡ The question of the formation of the Norfolk Broadlands has been discussed by other writers, and therefore is not considered here.

Lowestoft Ness.* Traditionally, Yarmouth is said to have originated as a small fishing encampment on a sandbank which formed across the wide estuary of the Yare-Waveney about the year 1000. The "Hutch Map" (A.D. 1000?) is a picturesque attempt to show the coast as it then was.† While no reliance can be placed on such a map as this, there is no reason to doubt that such a bank would form across the estuary, and would in course of time become joined to the mainland. At first there



4. Sketch-map of the Yare spit

were two entrances to the river, one to the north of this bar, called Grub's or Cockle Haven, and one to the south. The northern one was soon obstructed by shingle and sand travelling from the north, and consequently the southern entrance developed into the main one. But this, too, was subject to great fluctuations, and was gradually pushed farther and farther southwards, attaining a maximum distance from the present town of Yarmouth about 1347, when it reached to a point somewhere between Gunton and Corton. Naturally such a shingle spit was a considerable hindrance to navigation, and the burghers of Yarmouth had to make many cuts through it. The present entrance to Yarmouth Haven (apart from minor shiftings) dates from 1566.‡

The growth of this Yare Spit seems to have had a considerable influence on Lowestoft. At the latter place the cliffs are now fronted by a flat shingle and sand foreland, called the Denes or Ness. Gillingwater, § the historian of Lowestoft, says that in Roman times these cliffs were reached by the sea.

Unfortunately, no definite evidence is given for this statement. It is, however, by no means improbable for reasons which will appear

* Vide Redman, "The East Coast between the Thames and the Wash Estuaries," *Proc. Inst. Civ. Engs.*, vol. 23, p. 186; and *Geol. Sur. Mem.*, 1890, "Yarmouth and Lowestoft," Blake.

† A much more accurate picture of the coast in early times can be obtained from a study of the 1-inch geological map, the alluvial areas on this map corresponding approximately with former arms of the sea.

‡ Vide *Mem. Geol. Sur.*, J. H. Blake, 1890. This is the eighth haven.

§ E. Gillingwater, "An Historical Account of the Ancient Town of Lowestoft, in the County of Suffolk." 4to. London: 1790.

later One piece of evidence does certainly point to the comparatively late growth of the Ness. The first known mention of it appears in the Hundred Rolls, temp. Ed. II.* The map shows that at the present time the general trend of the line of cliffs from Gorleston to Corton is continued along the outer line of the Ness (*c . . . d* on map); and that near Corton the cliffs themselves take a fairly conspicuous change in direction.† If, in imagination, the former Yare spit be prolonged as it was in 1347, it will be seen that its outer edge was continued more or less into the line of cliffs now standing at the back of the Ness at Lowestoft (line *a . . . b* on map). In 1392 a second haven was cut at the north end of Gorleston. Four other cuts were made before 1566 when Yarmouth harbour was stabilized, and shingle travelling from the north was held up there by groynes. As a result of these several cuts the shingle of the severed part of this spit became "dead," and sooner or later disappeared southwards. This having taken place, the sea could cut into the cliffs between Gorleston and Corton, there being very little shingle travelling down the coast to protect them. Such erosion would probably become pronounced near Gorleston, because there the amount of beach material would be least (*i.e.* just under the lee of Yarmouth Harbour).

Possibly the sea attacked the cliffs at Lowestoft also. But, arguing from a similar case at Shingle Street (see Orford map), there is reason to expect that a certain amount of shingle had collected here. This would be natural enough since the Yare spit was comparatively thin, and large masses would be cut off in storms and probably driven ashore at or near the present position of North Lowestoft. This shingle would naturally protect the cliff in rear and so help to withstand the attack of the waves. Working on this assumption, then, we may conceive of the sea gradually forming the broad bay between Yarmouth and Corton, and the longshore current,‡ moving southwards, carrying a certain amount of material from this stretch of coast. In other words, the longshore drift gradually changed from the line *a . . . b* to the line *c . . . d*. When this current reached Corton the shingle at the foot of the cliffs diverted its course a little seaward, leading to further deposition and eventually to the formation of a spit or ness. Together with this action there was probably (as already noted at Blakeney and Scolt) a general landward movement of ness and cliffs alike. This is still going on, and Lowestoft is making expensive provisions, in the form of sea-walls, to resist this erosion. It is highly doubtful if they will be of any permanent value. The natural protection of any coast is a beach of the sea's own construction. As long as Yarmouth cuts off the beach supply from the north, so long will Lowestoft suffer. It is interesting in this connection to note that the

* Redstone, V. B. Information contained in a letter to the writer.

† This is more apparent when viewed actually from Lowestoft Denes.

‡ This term is used in a broad sense here and includes beach drifting.

holding up of beach drift at Yarmouth is causing the beach there to prograde and the dunes to the north of the town to extend.

The question of time involved in this suggestion for the formation of Lowestoft Ness is important. Exactly how far the Yare spit extended before 1347 is uncertain. The first haven was cut in that year near Gunton.

Probably well before this time the spit had attained such a length or even longer, and Lowestoft Ness had been in process of formation for the same amount of time. If Gillingwater is right in saying the cliffs were reached by the sea in Roman times, there are about 1000 years or more in which to account for the growth of Lowestoft Ness.* Judging by the known growths of such shingle headlands as Dungeness, Orford, and Scolt in England, Cape Carnaeral in the United States, and the Darss in Germany, this period is quite sufficient.

6. Lowestoft to Aldeburgh: Dunwich.

Continuing southwards from Lowestoft † there is a very interesting stretch of coast, along which many changes have taken place. Unfortunately, the exact history of these changes is lost. An old document, "The Butley Cartulary," throws much interesting light upon them. The original document (date 1237) is in the Bodleian, but Suckling gives a full account of it in his 'History of Suffolk.' ‡ The *raison d'être* of the document is the apportionment of wreck of the sea. From it, it would appear that all the small streams—Kessingland, Benacre, Minsmere, Hundred (Aldeburgh)—were then open and served as havens. These are now completely closed and their waters find egress by means of sluices or by percolation through shingle banks. In some cases, as at Easton, very beautiful broads are left, merely separated from the sea by a shingle bar. Perhaps the greatest alterations have taken place at Dunwich.§ Dunwich, formerly an important mediæval city and possibly the seat of a Bishop, is now practically destroyed. In the days of its prosperity it ranked as a port of no small consequence, and was then situated at the head of an estuary formed by a shingle bar. The small Dunwich river joined the Blyth, and both shared a common but variable mouth near the present position of Dunwich.

The history of Dunwich is the history of all the east coast havens; a haven constantly blocked by storms and liable to shift. There was also,

* *I.e.* about 1000 years before the Ness is first mentioned (*temp.* Ed. II.). *Vide* also Gillingwater, 'History of Lowestoft.'

† It is rather doubtful if Lowestoft Harbour was ever a true outlet for the Waveney through Oulton Broad and Lake Lothing. In storms the sea did occasionally break over the low land into Lake Lothing. Between this lake and the sea and between Lake Lothing and Oulton Broad are two glacial ridges. This lowlying area was probably the place known as Kirkley Haven. (See 'Lowestoft in Olden Times,' by F. D. Longe.) Wheeler ('The Sea Coast') thinks it was a former mouth of the Waveney.

‡ Suckling, 'History of Suffolk,' vol. 2, p. 305.

§ Steers, *Proc. Inst. Suff. Arch. and Nat. Hist.*, vol. 19, pp. 1-14, 1926 (for 1925).

as to-day, great erosion along the cliffs. Prior to 1328 the haven mouth was near Dunwich, but a great storm in January of that year blocked it up. This led to the usual trouble with Southwold and Walberswick before a decision could be reached where the new haven should be cut. Redman (*op. cit.*) has suggested that the new haven was Buss Creek, which lies just to the north of Southwold. There is, however, little reason to suggest this, because Gardner,* the historian of Dunwich and Southwold, makes no mention of it as a haven mouth. The mistake is due, probably, to reading leagues instead of miles,† for "Leucas." (At some earlier period Buss Creek was open to the sea, but it seems to have been closed before the thirteenth century.)

In brief, the history of the Dunwich coastline seems to have been, first, the development of a spit which deflected the River Blyth to the south. In course of time this spit attached itself to the cliffs at Dunwich and the waters within, either naturally or artificially, found egress where the haven stood prior to the storm of 1328. It is impossible to say, with any pretence to accuracy, what happened before that date, but it is reasonable to assume that this haven was not the first. Certainly many later cuts were made through the obstructing shingle, but none lasted for any length of time. In the eighteenth century the shingle seems to have been cast back on to the marshes, and since that time erosion has removed nearly the whole site of the old town.

From Lowestoft to Aldeburgh the coast is formed of soft sandy cliffs alternating with low shingle banks, sometimes capped by small dunes. There are two small "nesses," the one at Covehithe, the other at Thorpe. Both are small sand and shingle headlands which originated first as spits deflecting the Kessingland and Hundred rivers. Commencing at Aldeburgh is the greatest of the east coast spits—Orford Ness.

7. Orford Ness: Its History and Evolution.

Orford Ness is a shingle spit of pronounced cusped pattern. Its length is about 11 miles. Orford Ness proper is the name given to the apex of the spit. The extreme south end of the spit is named North Weir Point, probably a corruption of North Eared Point, a name suggestive of its recurved nature.‡ Throughout its entire length there is scarcely any sand to be seen except at low spring tides. The shingle is piled up in orderly series of "fulls" or ridges. The intervening hollows are called swales or slashes. The spit, like Dungeness, grew out into comparatively deep water, and, up to the Ness proper, gradually receded farther and farther from the land.§ The former coastline is

* Gardner, 'History of Dunwich,' 1754.

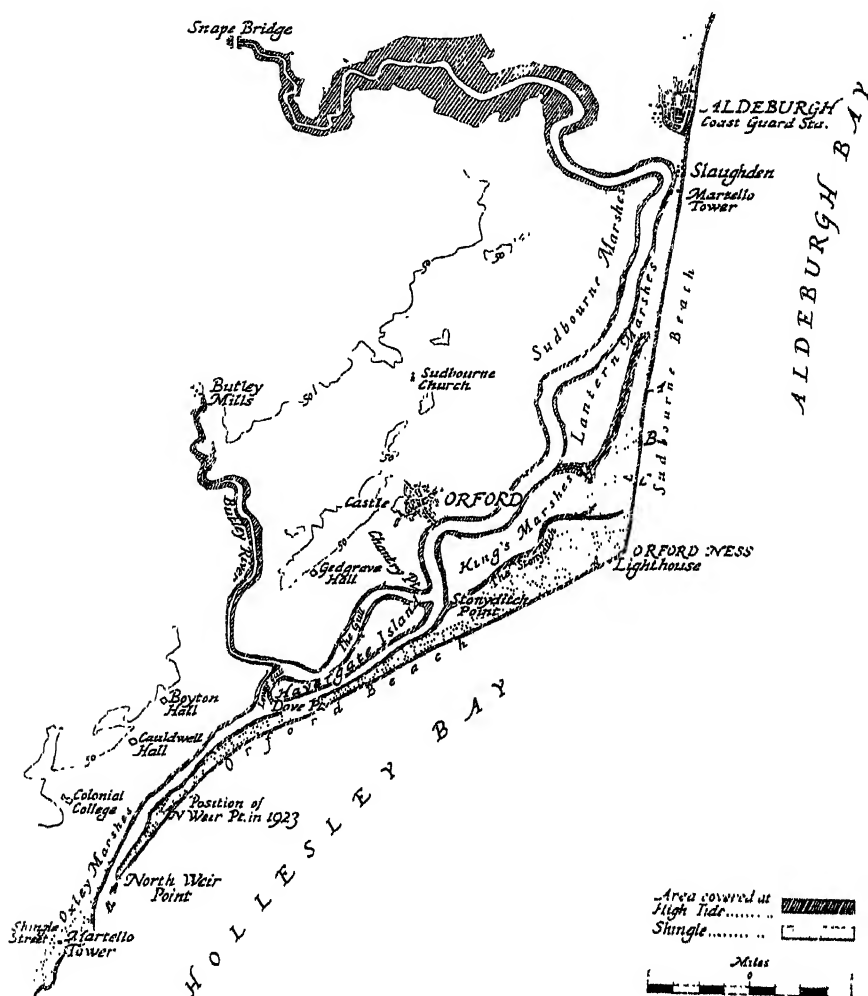
† *Vide* New Eng. Dict., under "League."

‡ See 'Memorials of Old Suffolk,' p. 226, ed. V. B. Redstone. 1908.

§ The spit grew southwards: the old coastline ran more or less south-west from Aldeburgh. Hence, as the spit lengthened its distal end receded farther from the land.

clearly marked by a line of high ground running more or less directly from Aldeburgh to Bawdsey.

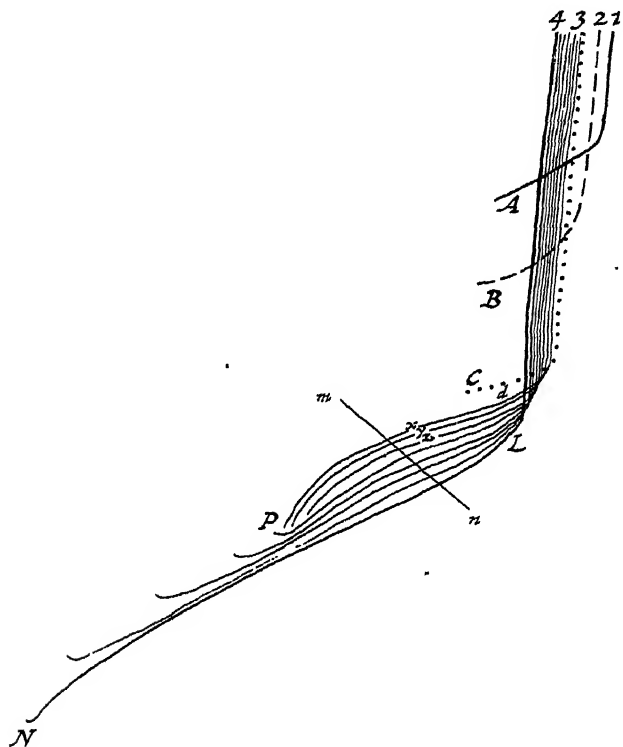
Ancient maps and documents permit the study of the growth of this spit in some detail. The oldest known chart of this area is of the time of Henry VIII. (c. 1530). It is really a chart of the whole coast from the



5. Sketch-map of Orford Ness, reduced from O.S. 1-inch map revised 1905-07

Orwell to Gorleston, and seems to have been intended for use in coast-defence schemes. On this map the entrance to the river is shown just opposite Orford. The chart is very rough and unreliable. The next map (temp. Eliz.) suggests the haven entrance had shifted southwards

to a point midway between Boyton and Cauldwell Halls. A. Appleton's map of 1588 is very similar. In 1601 the area was carefully surveyed by Norden, who produced a large and detailed map of considerable accuracy. Here the haven entrance, allowing as far as possible for the inaccuracies of the earlier maps, is shown in much the same position as on the Elizabethan map. Saxton's (1575) and Speed's (1610) maps quite obviously represent the coast as it was at a much earlier period. They are very diagrammatic, and help little in the solution of the problem. Maps of the seventeenth and eighteenth centuries continue to show the



6. *Evolution of Orford Ness. No attempt is made to show exact number or orientation of ridges: there are 40 across m—n*

southward growth of the spit. In 1805 the first edition of the 1-inch Ordnance Survey Map was published. Bryant's map of 1824-25 is in close agreement with this. The next edition of the Ordnance Survey Map in 1838 shows further growth. The maximum length seems to have been attained in 1897. Between that year and 1902 storms cut off a considerable part. In 1923 the spit was growing once again.

Accepting the accuracy of Norden, and assuming the maximum length was reached in 1897, we have a growth of nearly $2\frac{1}{2}$ miles in about

300 years (1601-1897), an average annual addition of about 15 yards. If we assume the relative accuracy of the Henry VIII. and Elizabethan maps we must also assume that the spit grew about four times as fast prior to 1601. This is improbable. But it is quite probable that Orford, which, like Dunwich, was once a thriving port, became important just about the time when the spit had extended far enough to be a protection and not a menace to Orford's Haven. Orford Castle was built in 1165, and then Orford was a prosperous port.* Physiographically, this period in Orford's history possibly coincided with the time when the spit had reached such a position as is indicated in the Henry VIII. map, and for this reason, as well as that based on the probable rate of growth of the spit, it is assumed that this map represents the coast as it was some two or three centuries before Henry VIII.'s time. If this be the case we have to deal with a growth of the spit of about $5\frac{1}{2}$ miles in 700 years (1165-1897), or an annual leeward progression of about 13 yards, a figure in close agreement with the 15 yards since Norden's Survey.

The evolution of the spit can be traced by studying the disposition of the shingle ridges. Each individual ridge at one time formed the end of the spit. The older ridges are much less distinct than the newer ones, owing to their being gradually flattened by weathering and gravity. However, their trend lines are still quite clear because the larger pebbles, under the sorting action of the waves, tend to remain in the swales or on the ridges. Further, the swales and ridge tops are often well marked by vegetation, which seems to favour these parts of the ridges rather than the flanks.

From Thorpe Ness to Aldeburgh and on to Orford Ness there is really one main ridge of shingle. Several minor and parallel ridges are superimposed on it, but may be neglected for the present. As this ridge is followed southwards from Aldeburgh it is seen to cut off obliquely many older ridges. These older ridges are in groups (A, B, and C on map), and are comparable to the Marams and Hood at Blakeney. No definite date can be given for the time of their formation, but they were almost certainly formed before the twelfth century. The most northerly group, A, runs nearly south-south-west (*c.* 206°), the next, B, rather more to the west (*c.* 216°), and the third group, C, runs at an angle of

* (a) This is the more probable because a great number of the shingle ridges do cease at a place (Stonyditch Point) which corresponds approximately with the position of the south end of the spit on the Henry VIII. map. (See also Steers, "Orford Ness," *Proc. Geol. Ass.*, vol. 27, 1926, pp. 306-325.)

(b) Balding and Turner, chap. v., 'Memorials of Old Suffolk': "Orford in 1164 was a thriving village, having a busy market-place. The erection of a castle increased its prosperity, and converted the once small hamlet of Sudbourne into one of the most flourishing of Suffolk boroughs."

(c) Redstone, chap. xii., *ibid.*: "When Henry II. built his castle at Orford in 1165 shingle had begun to collect at and upon the headland, Orford Ness. The town quickly developed from the small hamlet of Sudbourne to a thriving port, and finally to a flourishing borough *standing at the very mouth of the haven.*"

c. 56° to the main beach ridge. In each separate group the more southerly ridges turn more to the west than the more northerly.

The greatest development of ridges, often more than forty in number, is found around the lighthouse. It is difficult to make any hard-and-fast divisions in this area, but the following groups may be distinguished :

1. The present Main Beach Ridge.
2. The ridges on the sea-side of the lighthouse, which are enclosed by the Main Beach Ridge.
3. The oldest ridges, which run behind the lighthouse and are cut off north of it by group 2.

In this third group the older are again cut into, truncated (at P on map), by the newer near Stonyditch Point.* Southwards from this point the ridges run in long open curves, and are more or less parallel to one another.

Still farther south, near the present position of North Weir Point, a large part of the spit, comparatively recently, was cut off by the sea. Subsequent to this truncation, there has been a further alteration by the addition of a modern appendage to the spit, possessing many excellent examples of recurved ends on its inner side.

The spit owes its formation to the combined action of waves and the longshore drift. The longshore drift here runs to the south, to all intents and purposes parallel with the spit. Hence it works in conjunction with waves coming from the quarter between north and east—from off the greatest fetch of open water relative to Orford Ness. Such waves would cause southward-directed beach-drifting. It is probably not possible to separate the effects of these two actions. T. W. Marsh † has seen sand drifting northwards here with the ebb and shingle thrown southwards by the waves. Arguing from analogy with the Norfolk coast, wave action would appear to be the dominant factor, but when waves and longitudinal drift act in conjunction it is not easy to differentiate between them.

Orford Ness began as a simple shingle spit across the mouth of the Alde. There is every reason to expect that such a spit would recurve landwards, and grow forward as a series of such landward-directed hooks.‡ But as the spit continued to grow in this way, it progressed as a whole, seawards. This can be seen from the map, the 50-foot contour marking approximately the line of the former shore (see also footnote, p. 37). But always, it must be remembered, the waves would be slowly driving the whole beach landwards. The interaction of these processes may be shown as in the annexed figure (6).

Suppose the continuous line *x* represents the spit at an early period in its evolution. The recurved ridge marked *A* corresponds to those

* This truncation makes a very fine angle with the older ridges.

† Vide *Proc. Geol. Assoc.*, vol. 36, 1925, p. 434.

‡ Johnson, D. W., 'Shore Processes and Shoreline Development,' p. 289.

marked A on the map. In course of time the spit lengthened and at the same time was driven landwards, as shown by the chain-dotted line 2. Corresponding to this are the recurved ridges B. Repetition of this process led to the formation shown by the dotted line 3 and the recurved ridges C. These particular ridges, C, correspond to those a little distance to the north of the present lighthouse. The next succeeding ridges to be formed were those marked x , y , and z . When the earliest of these was formed there was a well-marked bay-like conformation of the spit (see the line dxP). As newer bars were formed the bay-like conformation gradually disappeared, so that at the present time the outer line of the spit runs as shown by the line 4LN on Fig. 6. Near the place marked P the bars called x , y , and z are cut across obliquely by the newer bars. This is the truncation near Stonyditch Point, which has already been referred to. Many of the older bars end here.

The spit continued to grow southwards, but at the same time decreased considerably in width. The extreme end of this thin part was necessarily unstable, and was caused to recurve landwards by the waves. Fresh material, however, was still coming from the north, and directly or indirectly lengthening it. The combined effect, then, of the waves and the constant addition of new material produced the long tapering part of the spit, with its well-preserved recurved ends, south of Stonyditch Point.

Whilst the spit may owe its general formation to wave action and to the longshore current, certain modifications were probably brought about by other factors. The ness point (*i.e.* the lighthouse point) is at the place where material drifting alongshore from the north should leave the coast and try to continue its course in a straight line.* In calm weather some material may merely "creep" round the point, but in stormy weather the greater force of the waves and other factors should carry material farther south. Such material would later be driven shorewards, and built up by the waves into ridges of considerable length. That such is the nature, in part, of the ridges south of the lighthouse is corroborated by observations made on two visits to North Weir Point at the end of March and early in April 1923. In this period, not characterized by any bad weather, a new ridge had formed. It was about half a mile long and merged northward into the previous main beach ridge. It appeared to be due quite definitely to the constructive action of waves acting along its entire length rather than to simple longitudinal accretion.

The effect of winds on the profile of the beach is important. As elsewhere on the East Coast, the prevalent winds are from a point between south and west; the dominant winds from north-north-east and north-east. Hence, during a period of normal winds the beach "makes," but suffers very considerable erosion during strong north-easterly winds.†

* The orientation of the Whiting Bank strengthens the argument.

† This erosion is very marked between Aldeburgh and Orford Lighthouse.

To some extent the change in the trend of the beach which takes place at the Ness causes the southern part of the beach to have rather more protection from north-east winds. However, toward North Weir Point the trend of the spit is again more nearly north and south, and so this part is exposed to north-east winds. Furthermore, the spit is here very thin, and often, as in 1897, great masses are cut off from the spit and piled up on the marshes at Shingle Street.*

Here there is an enormous amount of shingle, a good deal of it stabilized. It is worth noting that the great masses taken from the spit in 1897 were hurled on to that already existing at Shingle Street so as to enclose a deep lagoon, which was still in existence in 1923. Shingle banks protect the flat marsh lands from here up to Bawdsey Cliff. The shingle is still in transit southwards, and a small but very changeable bar runs across the mouth of the Deben. The beach is continued on past Felixstowe, and at Landguard Point, which has been well described by Redman,† there occurs another great shingle expanse showing the typical recurved forms. From this point on to the Thames shingle gradually lessens in amount.

8. The Origin of the Shingle.‡

A great deal of detailed work yet remains to be done on the East Coast, especially on north Norfolk. The origin of the shingle has always been a puzzle. Analysis shows that quite 99 per cent. of it is flint. The remainder consists of various resistant rocks, especially igneous rocks of Scottish facies and to a lesser extent Scandinavian igneous rocks. There are also occasional fragments of sedimentary rocks to be found, probably in part from the Jurassic beds of the Yorkshire coast. At present it is impossible to say precisely where this shingle comes from, but the gravels of the glacial beds which occur along nearly all of the coast must have supplied a great part of it. Further, boulder clay and other glacial sediments must have been left on the floor of the North Sea and may supply a good deal. The fact that most of the shingle is flint apparently points to an origin not far distant.

The full effects of winds, tides, and waves on this coast are not yet known with any precision. On the very shallow bottom off north Norfolk the tidal currents are very complex, due especially to the Wash and to the numerous small creeks and channels. How far the movement of shingle and sand is responsive to these and other effects is a problem only to be decided by future work.

* When a high spring tide occurs during a period of south-east winds, the level of the water in the North Sea is raised and is ponded back in the river, causing floods. Havergate Island has been almost completely flooded on at least two occasions on this account in recent years.

† *Op. cit.*

‡ See A. K. Coomaraswamy, "Sources of Pebbles on Blakeney Point," in Blakeney Point Report. 1915-16, pp. 14 and 15.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: We are to hear Mr. Steers on a subject which is probably very near to a good many of our hearts; that is, the erosion of the East Anglian coast between the Wash and the mouth of the Thames. I am an East Coast man myself and was born almost within sight of one place, a little to the north, where erosion has been very severe, namely, Spurn Head. I have no doubt others present will listen to the paper with the same interest as I shall.

Mr. Steers then read the paper printed above, and a discussion followed.

Prof. F. W. OLIVER: It is a singular thing that Mr. Steers should be the first person who has ever, to my knowledge, visited Blakeney Point for study other than as a bird man, a botanist, or a biologist. Times without number I have asked geological colleagues why they will not come to Blakeney Point and see how the many things which interest them when they become encumbered by subsequent layers are actually built. They go and dig in the ground and by sections imperfectly make out the buried topography which is all exposed to the observer on the surface in such places as Blakeney Point and Scolt Head. But in Mr. Steers, inspired by geographical ideals, we have the first man who has ever come to take advantage of the very evident facilities which such spots afford.

I know the coast of England pretty well, having walked round almost the whole of it, and the opinion I reached was that Blakeney Point should be the kindergarten of all shore study where building up is involved. I do not mean denudations and so forth; but wherever shingle, sand, and mud are involved, being separated and being thrown into *quasi* permanent beds, they are in the simplest way to be appreciated at Blakeney Point. Mr. Steers has pocketed his pride and come to the kindergarten, and that is an event in the history of Blakeney Point.

As regards what Mr. Steers found there and his observations, I personally am perfectly prepared to accept them, provided no other factor not yet apprehended should turn up. What I suppose interested him was the fact that here were two pieces of land both pointing west, growing and accreting at the westerly extremity, Scolt Head and Blakeney Point. Then he discovered that the tide flowed in different directions. Whilst the tide washes Scolt Head from east to west, it washes Blakeney Point from west to east at the period of the tide that matters, and involves the highest shingle. The demonstration of this is his particular achievement. I entirely agree with his data as far as they go, and I hope they will be extended. He has now put forward a provisional theory—and after all every theory is provisional—that it is what he calls the dominant wind from the north-east that matters chiefly in shingle drift. As regards violence and velocity of wind, of course that is not so. Last New Year's Day I recorded wind from the west at Blakeney Point blowing at 68 miles per hour, and we do not get that from the north-east, at any rate in my experience. On this theory, then, the north-easterly waves coming with a long fetch out of the North Sea more than neutralize those generated by off-shore winds, which of course are the prevalent ones. The balance represents the potential powers of growth of the spit in a westerly direction.

[Prof. Oliver then showed a series of slides illustrating why Blakeney Point proved such a good kindergarten. The first depicted the transverse travel of the beach in the landward or southerly direction, whilst a second group of slides showed the development of the Far Point, which had not existed prior to 1912, but of which a history as complete as could reasonably be expected had

been collected by repeated instrumental surveys during the last thirteen years. The speaker pointed out that the main beach advanced like an amoeba over the salt marsh, the pseudopodia, or talus fans, consisting of shingle cast over the crest by master tides which rose in north-westerly gales higher than expectancy, such tides being the ones which brought about the most evident change. The talus fans were somewhat scattered because the shingle was obstructed by lines of *Suæda* bushes growing on the beach, directing the flow of the shingle towards certain points. If the whole beach were properly afforested with this plant there should be no travel of shingle. In the next slide the new shingle fans were seen at a steep angle which had not gentled down as it would do in eight to fifteen months. Another slide depicted the sea face of the same beach, the principal features being an outcrop of mud, such outcrops being visible only on the very rarest occasions, though that shown was observed for about ten days and found to contain fossils, or rather mummified seeds and rhizomes, of the marsh plants growing in the days when the spot was a salt marsh on the other side of the beach. According to the data collected during the past twenty to twenty-five years it had taken the beach two hundred years to travel its own width, assuming it to have always progressed at the same rate.

With reference to the Far Point Prof. Oliver pointed out that it was a continuation of the main shingle beach and consisted of successive shingle spits. He then showed an interesting series of charts illustrating the development of this new system of shingle beaches, from 1913 to the present day, remarking that they could be taken as a fairly accurate history of the development of broad facts, the only chart drawn in free-hand being that for 1917, when, owing to the war, it was not considered prudent to use instruments. Continuing his comments on the paper, Prof. Oliver said :]

As regards the source of the materials going to the production of Far Point, that no doubt, is planed off the whole length of the bank. If one took its length as 7 miles and planed shingle off for a depth of 6 inches and 100 feet wide, and imagined it travelling west, it would work out at 70,000 cubic yards, which is of the order needed for these recent developments. It is evident waste is going on, and that it is not being made good further back, because there is nowhere at the present time whence such reparatory materials can be derived.

Mr. F. DEBENHAM : Any remarks that I can offer come from one who is merely a colleague of Mr. Steers in the School of Geography at Cambridge University rather than from one who has given very much study to coastal erosion. But from my memory of such works as the Commission Reports on the Coastal Erosion of the East Coast and one or two other papers on the subject, I believe Mr. Steers is the first man who has really withdrawn emphasis from the tides and added it to the winds. I think I am correct in saying that the majority of writers have said the tides have done most of the work of distribution, and that the winds are a minor factor. If I understand Mr. Steers' paper correctly, I think he is putting it the other way about. From a general study of erosion, apart from coastal erosion, one would be much inclined to follow him. One could quote quite properly the analogy of changes in land form in arid regions, where you have year after year wind erosion, frost erosion, and gravity changes going on, but which may be swept away in perhaps half an hour, or entirely altered by the single rainstorm they get every few years. The coast of Peru and Chile is an excellent example. If you study the erosion—either from maps or photographs—of the land forms on that very arid coast you are at once struck by the fact that it is typical flood erosion. I think Mr. Steers means somewhat the same thing when he speaks of the

north-east wind which, though less frequent and powerful, is the dominant wind, because of its direction, and it may well be the chief factor in forming the spits. I should certainly tend to believe that theory. I am not sure I would not go a good deal farther and say that what is really of importance is single individual storms. I do not know whether Mr. Steers has actually measured the effects of an individual storm, but it seems to me that that might very profitably be a basis for further research. For instance, those "fulls" and swales at Orford Ness and those curious recurved points at Blakeney Point tempt one to refer them to something catastrophic and individual rather than general continuous movement of the shingle. Perhaps Mr. Steers would not agree, but it strikes one that since there are individual ridges one may look for an individual cause, in point of time.

Mr. Steers did not say very much with regard to the recurved ends. They occur, as one sees from the photographs, particularly at Blakeney Point and, somewhat blunted, at Orford Ness. If they were all like those at Orford Ness, just a few yards at the end of the long ridge, I think one could accept them as the product of a swirl; but when they curve back and finally go in the opposite direction to the main outer drift of the shingle, as at Blakeney Point, one ought to ask for further explanation than mere swirl. Perhaps Mr. Steers can say what they are caused by. Mr. Steers has been naturally led to study the history of the coast, and that in itself is a form of research which is needed, and he has put very conclusively the extraordinary changes which are of such immense local importance, especially as regards Dunwich and Orford, the former now being a tiny village, whereas it once had both a bishop and a port. I am sorry Mr. Steers did not have time to tell us something about the way in which he is working at the problem and the methods he is using for studying the mechanism of these drifts. One would like to hear and probably like to question the measurements which he is making; whether, for instance, he is concerned much with the disposition of the sandbanks offshore, which one would, at first sight, say had a good deal to do with the force, if not the direction, of the drift. I conclude by congratulating Mr. Steers on his exposition of an important and very interesting series of changes in the East Coast of England.

MR. R. D. OLDHAM: I should like to remark that the idea of the drift of shingle being mainly caused by waves and not by tidal currents is by no means so new as the last speaker has suggested. It is some while since I first began to learn geology, yet in those days I was taught that the drift of the shingle along the shore was entirely due to the storm waves and not the tidal currents, and I have seen nothing since to modify that conclusion in any way. The tidal currents are nowhere strong enough to move shingle, but the waves are. When it comes to sand and mud, it is another matter, and Mr. Steers' observation of the opposite drift of the sand and the shingle is interesting and, I believe, new.

There is one question I would like to ask him: whether he has at all considered the question of the effect of any change of level that may have taken place? I think there is, round the English coast, very clear suggestion that there was a considerable lowering of the land relative to the sea in the thirteenth century. It was the time when Winchelsea was overwhelmed, when the Goodwin Sands were overwhelmed, when the Zuyder Zee was formed, and there are other facts pointing to the conclusion that the level of the land or the sea was unstable, and that there was a lowering of the land relative to the sea. In the case of the shingle spits, this would have the effect of complete or partial submergence, and this might account for the discrepancies in the rate of growth which Mr. Steers noticed, as between the older and more modern records.

Mr. J. A. STEERS, in replying, said: I was very glad to have Prof. Oliver's support on what I said with regard to Blakeney Point and Scolt Head and to waves being the dominant factor in their westward growth. I might say, *apropos* of Mr. Oldham's remarks in connection with waves and tides, that as far as my work goes I have been fully aware that both of these agents were at work. Either waves or tidal currents or both may be the chief factors in building a shingle spit. My point was that so far as I am aware no very definite suggestion had been made, beyond that in the map in Wheeler's book, as to how Blakeney and Scolt spits had been formed. With regard to the East Coast in general, one sometimes sees statements to the effect that the tidal drift is to the south, the inference being that Orford Ness and other spits are due to the southward-directed tidal drift. I think the tidal drift is an important factor. But I feel that waves are even more important, not only at Orford but on the Norfolk Coast as well. Then Mr. Oldham raised a point with regard to a possible depression of the land in the thirteenth century. I believe, in so far as Winchelsea and other places are concerned, that their destruction has been suggested by others to be due not so much to subsidence as to greater storminess at that time. I think I am right in saying that Brooks and others have suggested that the thirteenth century was a period of greater storminess than the period which preceded or has followed it, and the changes Mr. Oldham mentioned might conceivably be due to that rather than to actual subsidence, I am, however, unable to say anything very definite on that point.

Mr. Debenham raised one or two points regarding the formation, spacing, and length of ridges at Orford and other places. I cannot be certain, but from what I have seen I am rather inclined to think that these ridges are generally built in calm weather, and that in storms certain parts of the beaches are eroded. The several visits I made to the end of Orford Ness seemed to show that long ridges were not so much the product of longitudinal secretion, but were due rather to the constructive action of waves along their entire length; and I think that is the case elsewhere. It is difficult to say anything definite about the spacing and length of beach ridges. There is, I think, one important factor coming in, but I do not know how it works. At Orford the proportion of shingle to sand is very high: practically speaking, there is no sand. The eastern end of Blakeney Point is almost entirely shingle, but as you go westwards a great deal of sand, especially at the mouth of the harbour, is found exposed at low tide. In a general way the proportion of shingle to sand lessens as you go westwards. There is comparatively little shingle on Scolt Head, but in each case the long ridges and recurved ends are definitely built of shingle, though they may have dunes on them. I can only suggest that there is some connection between the proportion that the shingle bears to the sand and the shallowness of the sea, which determines the length and the spacing of the ridges because not only does the proportion of sand increase at Blakeney and Scolt, but also the water there is shallower than at Orford. At Orford, along the entire spit there is comparatively deep water offshore. At Blakeney, where the shingle is most abundant there is the deepest water. The secondary recurving of the lateral ridges is the work of waves at high water within the main shingle banks.

I am afraid I cannot at the present moment enter into a discussion on the methods of research I have employed. I regard this paper only as a start. I want to continue the work further and obtain further data. I hope some of the results are of interest.

The PRESIDENT: We have had an interesting paper and a very clear exposition of what has evidently been a very careful piece of work. We must

congratulate Mr. Steers and science on the fact that he has found out that "kindergarten" at Blakeney Point, and that he will probably visit it again. We had hoped to have been addressed by at least two other gentlemen from Cambridge; but restriction of the London and North Eastern Railway Service is apparently accountable for the fact that only Mr. Debenham has been able to get here. We are very glad, however, to have had him. I am sure you wish me to thank Mr. Steers on your behalf for his interesting account of what is a very vital matter to us all. Any one who knows North Norfolk realizes how serious coastal erosion is. My own College at Oxford has a large farm there and is very anxious. If any one who played golf at Brancaster in the early part of the century (as I have) plays there now he will realize what an extraordinary change may be produced in a landscape. I am sure you all hope that Mr. Steers will be able to return to the East Anglian coast and confirm or revise the conclusions which he has put before us to-day. I ask you, therefore, to signify your gratitude to Mr. Steers in the usual form.

Dr. F. S. Owens sends a written contribution to the discussion, of which the following is a summary:

In fixing when change in direction of tidal currents occurs the times of high water do not seem to me to have much bearing upon the question, as they represent the arrival of the wave crest, whereas the current determines the eddy. Doubtless the exact position of change varies. Float tests are affected by wind drift, not so much of the float itself, as of the water.

Mr. Steers has hardly done justice to previous investigators of tidal currents and beach drift. The writer's book* on coast erosion, published in 1908 with Mr. Case, deals at some length with the preponderating effect of waves over tidal currents for coarse materials. That the upper part of the foreshore is acted upon by the flood current only is pointed out, and the difference in the behaviour of sand and shingle under the action of waves and currents. The wandering of a channel in sand is well known, and is due to the interaction between the sand and the water. Harbour engineers know that while the ebb current cuts a definite channel in an estuary, the flood cuts across the ebb channel, and spreading wide makes subsidiary channels. Dr. Owens does not agree that the motion of shingle under wave and current action is very imperfectly understood, and thinks there is no general explanation which would apply to all cases. A very important factor governing the growth of sand spits is drift by the wind. Experiments this summer showed that a wind of 15 to 20 miles per hour can pick up damp sand between tide marks and transport it at the rate of about 18,000 tons per mile per week.

The experiments were made near Gore Point, which the author refers to as "another shingle spit subject to violent and rapid changes." It is not a shingle spit, but sand; nor is it subject to violent and rapid changes. The point has for some years been steadily eroded.

Mr. Steers replies that current observations confirm the tide table as showing that the flood current runs east at Blakeney and west at Scolt. Careful records of all details of float tests were made, and he is confident of their accuracy. He knows Dr. Owens' work well, but thinks that in East Anglia little is yet known of current effects. The wanderings of tidal channels in sand are not comparable with the major changes dealt with; and wind-blown sand is not important on shingle spits. The reference given to Gore Point speaks of frequent changes and an inner and outer range of shingle banks.

* 'Coast Erosion and Foreshore Protection,' by John S. Owens and Gerald O Case. St. Bride's Press: 1908.

THE ALASKA BOUNDARY DEMARCATION

Major E. W. Nesham, D.L.S.

Read at the Meeting of the Society, 14 June 1926. Map follows p. 96.

[The demarcation of the Alaska boundary was finished not long before the outbreak of the Great War, and that is no doubt the reason why no narrative of the operations has ever been given before at a meeting of this Society, though a technical paper on the Survey methods, and a sketch-map of the country north of the Porcupine River, were published by Mr. Douglas Nellas in the Geographical Journal for January 1913. The account of the general operations which follows is by a member of the Canadian Party, Major Nesham, now of the Gold Coast Survey. Major Nesham's lecture was illustrated by a large series of coloured slides, but the colouring makes it impossible to reproduce them as half-tone blocks, and the negatives are not available.—ED. G.F.]

A TREATY between Great Britain and the United States of America signed in 1906 provided for the demarcation and survey of that part of the Canada-Alaska boundary which follows the 141st Meridian. The Boundary Commissioners—Dr. W. F. King, Chief Astronomer of the Department of the Interior for Canada, and Mr. O. H. Tittmann, Superintendent of the Coast and Geodetic Survey for the U.S.A.—immediately started work on this survey. Their task was to project a line from the Mount St. Elias Range to the Arctic Ocean.

The first conference of the Commissioners was held at Washington, D.C., on 23 November 1906 and following days. The principal points agreed were, that as a Joint Party had observed for longitude on the south bank of the Yukon River in 1906, and as the agreed longitude of the observing pillar was 9 hours 24 minutes 00.027 second west from Greenwich, or 17.62 feet west of the true meridian of 141° west from Greenwich, the initial point of the boundary-line should be located in accordance therewith; that an accurate azimuth should be observed by a joint party at the initial point, and a mark set determining the direction of the boundary, which should be produced to the north and to south; that the line should be projected with the micrometer theodolite and marked by large and small aluminium monuments set in rock or concrete at intervals of 4 miles, more or less, and intervisible, if possible; that the position of such monuments should be controlled by a belt of triangulation extended along the boundary, and a vista 20 feet wide should be cut through all timber encountered; and that a topographical map, scale 1/62,500, should be made of the country not less than 2 miles on each side of the line.

It is impossible in the short space available to describe in detail a survey which took eight years to complete, but a general description of the country and of the conditions of survey can be attempted. To bring

to a successful conclusion the survey of a line approximately 700 miles long through country so varied, much of it unexplored, where the average "season" was only one hundred days, required perfect organization, efficiency of equipment and the enthusiastic cooperation of the *personnel* comprising the two parties.

The work was divided, the United States party carrying out triangulation and topography generally, whilst the Canadians undertook the placing and tying in of monuments, line measurement by stadia between the monuments, vista cutting, and photo-topography. The line projection was carried out by a joint party.

Precise levels were brought up from tide water at Skagway, Alaska, to the boundary at White Pass by the United States surveyors, and carried *via* the White Pass Railway, Whitehorse-Dawson waggon route, and the Dawson-Glacier waggon road and pack trail to station G South, on the 141st Meridian, a distance of 491 miles.

Conditions of supplies and transport had been greatly improved since Mr. Wm. Ogilvie was first sent to fix the meridian on the Yukon River in 1887. The White Pass Railway train was now taking eight hours to cover the same distance it took seven weeks to cover in 1887; Dawson City with its wharfs, hotels, and telegraph had been built; while river steamers ran fairly regularly between Nome, Alaska, and Whitehorse in the Yukon Territory. The establishment of base camps was simplified because many rivers, some navigable by river steamer or launch, crossed the line.

In order to get *personnel*, horses, and supplies to the various starting-points along the line two motor launches, each 40 feet long with an 8-foot beam, were designed to draw about 14 inches of water, unladen. They were both of the stern-wheel type, the Canadian launch having an engine of 25 horse-power, while that of the American craft was slightly more powerful. The launches drew 18 inches of water when loaded, but could carry very little freight in addition to their own fuel and supplies, but each launch was capable of hauling a 35-foot barge carrying about 8 tons. In addition to these two launches the Canadians chartered a small launch for carrying mail and for freighting, as it could handle a small barge carrying about 2 tons of supplies. The Americans hired another stern-wheel launch similar in pattern to the first two. During the seasons of 1911 and 1912 the launches made a total of 30,000 miles, distributing men and supplies to base camps and dumps on the White, Ladue, Black Porcupine, Yukon, and Old Crow rivers, whenever a sufficient depth of water was available, usually in the spring or when the snow on the higher hills melted in July.

As the work progressed other means of transport were brought into use, besides the pack trains which distributed supplies along the line or moved camp: dogs for summer packing as well as for spring or winter sleigh hauling; single-horse sleighs; back-packing by men; rafting

downstream; man sleighs; and scows man-handled upstream. Waggon were used in 1909 and 1913 to take parties into the White River country; but spring conditions were so bad that such a journey was very slow indeed.

In 1909 it took about three weeks to get to Canyon City on the White River from Whitehorse. The first nine days were spent on a "waggon road." On this the waggons often went into deep mud holes, and then all hands and horses were needed to get the outfit on to hard ground again. Deep snow, where trail had to be broken; no snow at all, where waggons had to be taken over by double teams; and rotten ice on Lake Kluane, were some of the incidents on this trail. At the crossing of the White River on May 21 the last ice bridge collapsed only half an hour after the last team had passed over.

The horses selected for the pack trains of the Canadian party were range horses, bought in bunches, unbroken, from the ranches of British Columbia, the American horses being similarly bought in Washington and Oregon. These horses were used to rough conditions and lived and thrived where stall-fed animals would have died. To feed a hundred horses with hay and oats would have made the cost of the survey prohibitive, and although many tons of feed were freighted to base camps, it was sparingly used, mostly in the spring and fall. Much good grass was found along the rivers and in burnt-over ground, even inside the Arctic Circle, in addition to which willow tips and pea vine varied the fodder. As it was impossible to take the horses out of the country for the winter season, they were herded out on the pea-vine covered bars of the White River. The hardiness of the breed enabled many to winter, but casualties were heavy, and new stock was brought in each spring to fill up the pack trains. It was found necessary many times to night-herd the horses, as, should camp have been pitched in a locality where feed was poor, the animals would wander back to the last good feeding-ground or would range over a wide area in search of grass. From this cause the projection party of 1911 was held up for two weeks. Picketing was of course out of the question, as the only feeding-time was during the late evening or early morning, and any curtailment of liberty to range in search of food would quickly have left the party without horses.

Supply dumps had to be made animal-proof as far as possible. Usually four trees, a suitable distance apart, were chosen, cross-pieces lashed to them at about 12 feet from the ground, and a platform of poles made on which the supplies were "cached" and covered by a tarpaulin. Pieces of tin were nailed around each supporting tree to keep down small tree-climbing animals. Bears proved the worst nuisance. One huge brown or grizzly bear managed to rob a cache placed over 10 feet above ground. Everything was destroyed or eaten—even some cement in sacks. The loss of this cache meant short rations for some time, and we hoped sincerely that the cement had caused the brute indigestion.

Fresh meat was obtained in some form or other all along the line. Moose were seen as far north as the Firth River. Woodland caribou ranged to the Old Crow River, while between the latter river and the Arctic Ocean barren land caribou were shot. White sheep (*Ovis Dalli*) were seen at intervals all along the line, especially in the neighbourhood of the White River, where many hundreds were observed in small bands. Fannen's sheep were found only on one range about 40 miles north of the Yukon River. Goats, though plentiful in the neighbourhood of the meridian, were not encountered on the line of survey. The hills of the Skolai River, about 55 miles west of the line, proved to be a regular goat pasturage. Black, grizzly, and brown bear were shot, the latter of great size, one track measuring 14 inches. A bear of this species treed a packer for several hours, while another was seen chasing the pack-horses, and traces were found of a caribou carcass covered with moss by these animals. On another occasion one was seen chasing a young sheep in the slush ice. Bird-life was plentiful. Ptarmigan above timber limit, bush partridge or willow grouse in the valleys, and many different waterfowl in the low-lying swamps near the rivers, especially in the Yukon Flats near Fort Yukon, where the valley of the river broadens out and immense tracts of marsh country give sanctuary to innumerable waterfowl during the breeding season.

Many specimens were collected for the museums, and a geological reconnaissance of the whole line was made.

As the conditions of survey, and the country over which the line passed, were more or less the same throughout, with the exception of the extreme north and south ends, a general description will suffice. The country was undulating, the hills rising to mountainous, generally with deeply eroded stream-beds. Heavy timber was usually encountered in the valleys, while the summits were bare or at best covered with a sparse growth of stunted timber or low bush. Many deep, wide game tracks were found and used as trails; where new trails had to be followed ridge tops were favoured except in the more mountainous country, when the valley bottoms furnished the best route. The thick "Caribou" moss overlying almost the whole of the lower country made progress very difficult and tiring. Wood and water for camp use were everywhere plentiful.

The long days of these high latitudes aided the work materially, particularly on the more northerly section. The length of the season being short, the day's work was long, especially for helio-parties and photo-topography.

Mosquitoes were plentiful, but by using evil-smelling preparations or "dope" and the mosquito bar by day, and by sleeping in mosquito-proof tents by night, the discomfort caused by these pests was minimized. Dope might be anything from oil of citronella to bacon grease. The mosquito bar was worn over a broad-brimmed Stetson hat and tied

under the arms to keep it in place ; a hole was provided through which a pipe could be smoked. Casualties, through the smoker lighting his pipe carelessly and setting fire to his mosquito bar, were fairly numerous. These bars were uncomfortably hot ; but anything was better than the constant irritation of myriads of flies and mosquitoes. At night smudges were made of green brushwood and moss thrown on a fairly bright fire. This proved the best method of keeping away the insects at night. The horses, however, were often so bothered that they were unable to rest or feed, and were seen in the morning on some high rocky ridge up in the wind, from which place it sometimes took hours of patient toil to get them down again. It is impossible to describe the effect on the "cayuses," as the horses were called, when the first animal covered from ear to hoof in a mosquito blanket appeared amongst them.

In 1907 a joint party travelled to the boundary from Dawson City on horse-drawn sleighs over the river ice, which means, under spring conditions, a succession of rough ice, snow drifts, and surface water. As rough ice will upset a sleigh and snow drifts have to be dug through, while water causes feet to freeze, it can be easily seen that progress was not swift.

This party observed for azimuth, and on the arrival of the main body in June the projection and survey of the 141st Meridian was begun. The method of projection used has been fully described, with the precise-level results, in the paper by Mr. D. H. Nellas.

The first permanent marks on the boundary were two large pyramidal bronze monuments which were set on either bank of the Yukon River. From here the line runs southwards across the watershed of the Forty-mile river to the Sixty-mile river, where a check-base was surveyed.

In 1908 the helio men of the projection party ascended the White River as far as Canyon City in small boats. The usual method of propelling a small boat up one of these swiftly flowing rivers is by poling, but survey parties unfortunately cannot be made up of river experts alone, so the method adopted by the surveyors was to pull the boat up by ropes. Often the only route was by the bed of the stream, which, when it is taken into consideration that ice was generally still on the river-bank in the spring, was by no means a pleasant experience.

From the "check base" already mentioned the line was continued over a spur of the Wrangell Mountain and across the White River to the foothills of the Natazhat Range.

The projection party had left the slower-moving parties far behind, and in 1909 a big combined effort was made to complete the Yukon River-Natazhat Range section before the end of the season. Fifty-one men and eighty-three horses were sent in overland from Whitehorse to Canyon City, a journey which took three weeks to complete.

During this season an attempt was made to climb Mount Natazhat from the south, but weather conditions were unfavourable. A further

attempt was made at a later date to climb this mountain, and the following extract from the official report (dated 11 August 1909) may be interesting :

"The trail led over the divide on glare ice, where steps had to be cut for nearly half a mile. . . . It began to snow, but we had to go on, as it was impossible to recross the divide in the storm, and reached camp at 8.30 worn out and chilled to the bone, found the tent down, and everything wet or frozen. . . . During the night it snowed 25 inches, and continued snowing the greater part of the next day. Even with the oil stove burning full blast and three men in the little 7 by 7 tent the thermometer registered only 32°."

During this season a reconnaissance had been carried out up the Porcupine and Black Rivers by motor launch to prepare for the next. This was the first time the sound of a power boat had been heard in these waters. The line had also been projected north from the Yukon River for 40 miles.

In 1910 the line was projected from this point across the two branches of the Black River and over a succession of plateau-like ridges to Rampart House on the Porcupine River, where the horses had to swim across one at a time tied to a canoe. No chances could be taken, as the rate of work depended largely upon the number of horses.

The trading post occupies the buildings put up in 1891 by a survey party sent in to fix the Meridian, and there was much discussion as to which side of the new boundary-line the building would be. When it was known that the post was on Canadian territory the Union Jack was hoisted and the occasion duly celebrated. The projection party put their horses, six in number, on a scow and floated the 225 miles down the river to Fort Yukon in four days. Soon after this snow fell and the Porcupine River began to freeze.

No effort had ever been made to bring supplies up the river by power boat, and a new era for transport in these regions began when in 1910 the first Survey steamer arrived with 50 tons of supplies. News, even in the thinly populated north, travels fast, and a motley gathering of natives with their dogs greeted the Survey steamer in 1911. The handling of 150 unbroken horses, the "bronco busting," and shoeing caused intense excitement and considerable amazement. The shoeing puzzled them. Why should horses need iron shoes? "Moose and caribou do not need them." The first Indian on a horse's back was a local hero for several days.

The line-projection party reached the British Mountains about 25 miles from the ocean, having carried the line across the Old Crow flats, the Ammerman Mountains, and the Firth River. The final projection was not carried through until 1912.

In the meantime small-pox had broken out amongst the Indians at Rampart House, and the survey was much hampered through the Quarantine Regulations which were enforced by the R.N.W. Mounted

Police. The party was given a wide berth by the Indians in 1912, as they blamed it for the small-pox epidemic of the previous year.

Preparations had been made to complete the survey of the northern section, and the last monument was placed on the Arctic shore. Topography was extended 6 miles to the east and 15 miles to the west along the coast. Franklin's Demarcation Point was found to be about 7 miles west of the Meridian. It had formerly been the winter rendezvous of the Eskimos of this district, but was abandoned for Herschel Island when the whalers made the latter place their headquarters. The ruins of their old huts, or barabaras, still remain. The point is not a prominent feature, as it is merely a long narrow sand-spit. It does not project out to sea, but simply forms a narrow barrier extending across Demarcation Bay.

Few Eskimos were seen by the parties. One family was encamped at Clarence Bay. With true Eskimo hospitality the man invited the survey party to share his frugal repast of tea and fish. He took great pride in showing his family treasure, such as a broken alarum clock and a trunk which he appeared to value very highly. Tundra runs parallel with the coast-line, and near the last monument it is about 15 miles in depth. Here mosquitoes dwell in their millions. No shortage of firewood was experienced, and even on the shore itself driftwood was available in large quantities.

The launch parties during their trip up the Old Crow River discovered Mastodon remains, of which rumours had reached us. Many tusks, teeth, and bones were brought away as souvenirs. There are doubtless many more such tusks buried in the sands of the river-beds in the vicinity.

It was considered impossible to project a line over the Natazhat Range, as the line crossed at an elevation of approximately 12,000 feet, over perpetual snow and ice. Triangulation was therefore carried out in 1912 from the end of the White River system of 1909 across the Skolai Pass, south and up the Valley of the Chitina River to the line. A base-line was measured in the Nizina Valley and much topography done up the Anderson Glacier. All was now set for the season of 1913.

A Canadian party went into the White River at Canyon City following the old 1909 trail. Their work was, if possible, to tie in the 141st Meridian survey with the South-Eastern Alaska Boundary survey by climbing Mount Natazhat and observing Mount St. Elias. The attempt to climb the mountain was successful after two failures, but clouds came up quickly and no result of any real value was obtained. However, by connecting the topography to the head of the Anderson Glacier by means of photo-topographic stations westward up the Klutlan Glacier, and then up a long narrow glacier which ran in a southerly direction near the line, the topography of the whole line was completed. The elevation of Mount Natazhat is 13,500 feet.

The equipment selected for all the parties working on the snow- and

ice-covered mountains between the Nazahat Range and Mount St. Elias was selected for its durability and lightness in order to meet the conditions of glacier travel. The tents were after the pattern of those used on the recent Antarctic expeditions, and could be set up by a single alpine-stock. Eider-down sleeping-ropes, alcohol-burning stoves, and Eskimo "Parkas"—a smock-like garment the hood of which is trimmed with fur—and the usual mountain-climbing gear were taken. The staple food of the climbing party was baked beans in tins. Chocolate was used during the actual ascent. The lack of water, other than that from melted snow, caused great discomfort. The party on the Mount Natazhat climb were unfortunate, as their ice-axes had not arrived from Vancouver. This party freighted their supplies on sleighs, three men to each sleigh, up the Kutland Glacier to the southern slopes of Mount Natazhat, occupying camera stations *en route*. By the last week in May they had back-packed their tents and instruments up to about 10,000 feet. Here the camp was pitched on a small plateau overlooking a sharp drop many hundreds of feet on to a glacier. From here a climbing party of four managed to get on to the ridge with the instruments; but a sudden storm, such as is known to all climbers of high altitudes, drove the party down when within a few hundred feet of their objective. The instruments, including a 6-inch theodolite, tripod photo-topographical camera and plates, etc., were left on the top. Camp was reached late the same evening, but the storm increased in severity, and snow fell for three days. Small snow slides became frequent, and it was decided to descend to a camp at a lower level, not however before a slide had nearly pushed the tents and their occupants over the edge of the precipice. The trail down crossed a very steep snow slope where, on the upward journey, a hard crust had made climbing easy. This crust was formed by the melted snow freezing again during the night, and usually retained its strength for some time after sunrise.

Now however, with 2 feet of newly fallen snow, the journey down became one continuous flounder in soft snow, and the party was nearly smothered by miniature snow slides. A second attempt to climb this mountain from the lower camp, at about 8100 feet elevation, was successful on June 18, the climbers starting before dawn when the snow surface was hard.

At about 11,500 feet however, after the sun had made an impression on the crust, when the climbers were on the long steep slope near the top of the ridge, a big snow slide took place. The first three men on the rope were swept down, but fortunately the fourth man was outside the line of the slide, and held fast. It was decided to go on over the track of the slide, and many anxious glances were directed up that slope before the top was reached. About seven hours were taken to climb the ridge. The instruments were found buried under 5 feet of snow. From this point deep snow made travelling very laborious, and on reaching a

prominent snow dome it was decided to leave one of the men, who was suffering from his feet, to occupy the point as a camera station at an elevation of about 12,400 feet. Storm clouds had been gathering for about an hour, and it was realized that the chances of taking any observations on the summit were small. It took three hours' hard work to complete the climb to the summit.

The view from the ridge had given impetus to the ever-increasing desire to gain the summit, but, almost coinciding with the arrival at the top, clouds and snow flurries completely spoiled the view. To the north could be seen the rolling tree-covered dark green hills with rivers winding like silken threads in and out of their sheltering valleys, while to the south lay the great snow-covered mountains which stretched range upon range as far as the eye could see and seemed to bar farther progress southward. A few beetles were seen lying frozen on the surface of the snow, and at 11,000 feet a small green humming-bird was picked up, but no other sign of life was seen, not even moose, after an elevation of 8000 feet had been reached.

The other Canadian and United States parties spent the season in the country between the Anderson Glacier and Mount St. Elias. The line was projected across the valleys at the head of the Chitina River, Mount St. Elias was connected by triangulations, and topography carried beyond the boundary for 25 miles up the Logan Glacier. The attempt to climb Mount St. Elias failed. Striking south from the Logan Glacier across 50 miles of snowfields the party eventually arrived at the foot of the mountain at an elevation of 9500 feet, and back-packed their supplies and instruments up to a camp at 13,500 feet.

The following is extracted from the Report :

" Looking to the south from this camp we could see below us the great Malaspina Glacier, and beyond it the Pacific Ocean. The Yahtse River was plainly visible, and in the sunlight, with every streamlet flashing, it suggested an arm of the sea. Icy Bay was also a noticeable feature, and stretching away to the west was the Coast Range at about our own level. Turning to the north, we could trace our route over the snowfields as far as the Logan divide. Beyond there appeared on the horizon Mount Wrangell and Mount Blackburn, and many other snow-covered peaks rivalling them in height, while one sharp peak in particular, seemingly more distant than the others, was very conspicuous. In every direction we could see a hundred miles or more, except to the north-east, the west shoulder of St. Elias cutting out the view there. It rose abruptly from camp 3000 feet, while farther to the right, 3 miles distant and 4500 feet above camp, stood our goal, the terminal cone of the mountain.

" Rising at midnight on June 29 to get an early start for the final dash, we found that a dense fog had filled the valleys, and storm flurries were in evidence about the summits. Before an hour had passed snow

began to fall, and it was midnight of the following day before the sky cleared, and even at that early hour the sun was lighting the summit of St. Elias. The instruments, food, and extra clothing were made up into packs, giving each man about twenty pounds, and about one o'clock a.m. the ascent was begun.

"Although cameras were taken along, the difficulties of the first part of the climb proved so engrossing that picture-making was forgotten entirely. We scaled a succession of cliffs, which one of the men declared were so steep that he was leaning backwards most of the time. Hands were used quite as much as feet, and to secure a firm grip on the rocks mittens were often removed, and although we were not aware of it at the time, several finger-tips were frostbitten. When outcrops of rock were not being traversed, the route lay over ice slopes where the cutting of steps was necessary.

"After nine hours of difficult climbing we were within a few hundred feet of the top of the west shoulder, and the rest of the climb to the summit appeared to be over a gradual slope presenting no obstacles. Four of the party only were feeling slightly the effects of the altitude, and all were confident of making the remainder of the distance, when a storm, such as is known only at high altitudes, overtook us. At first we were loath to admit that it was anything but a slight flurry, and continued the ascent. It soon became evident, however, that it was to be of more than temporary duration and that even if the summit were reached instrument work would be impossible, and so, at an elevation of a little over 16,000 feet, we reluctantly turned back.

"The descent was accomplished not without considerable danger, and great care was necessary to keep our footing, and in one place one of the men, who had been weakened by mountain sickness, slipped on an ice-slope and was well started on a swift glissade, when one of his companions below stopped him. Camp was finally reached at five in the afternoon.

"Rations were now very low, and, in order to make it possible to attempt another ascent, three of the men, who had been most affected by the rarity of the atmosphere, were sent to the base camp. Three others remained with me to await fair weather, but the storm continued unabated. We rolled ourselves in our robes for warmth, and only ventured out about once in every twelve hours to eat a little rice and bacon. At midnight of the 3rd of July the bacon was gone, and only a handful of the rice remained; eighteen inches of snow had fallen, and it was still coming down. The last hope of scaling Mount St. Elias had vanished, but we still hoped to be able to secure a round of photos at camp-level. About 3 a.m. the clouds suddenly raised, and a camera station near camp was occupied. Then packs were made up and we hastily descended to lower altitudes."

By a rather fortunate coincidence, the highest camp occupied by the

party on their attempted ascent of Mount St. Elias was on a small spur of the mountain on the western side, and the camera-station "Elbow" occupied by them while there was shown by the computation to be only 128.2 metres west of the 141st Meridian. The Commissioners therefore decided that the point of intersection with the Alaska Coast boundary should be on the meridian at the latitude of this station, the last course of the south-eastern boundary thus being from the summit of Mount St. Elias to a point on the meridian in latitude $60^{\circ} 18' 22'' 29$ north. Three monuments were set on the sides of the Logan Glacier and two south of Mount Natazhat on the Klutlan Glacier. The monuments had all been numbered, No. 1 being on the shore of the Arctic Ocean.

Although the survey in the field naturally takes first place, the value of the work done in the office by the computers and draughtsmen must not be overlooked. The distances and stations occupied will serve to show the magnitude of the office work: Projection, 557 miles; triangulation, 518 stations occupied; topography, 5938 plane-table and 210 photo-topographical stations occupied; geodetic levels, 510 miles; vista and stadia, 556 miles; monuments set, 202; bases measured, 7; azimuths observed, 3; magnetic stations, 197; geodetic positions determined, 609.

Maps on the scale of 1/62,000 were printed, 38 sheets in all, each sheet covering 15 minutes of latitude; the Arctic Coast being on Sheet No. 1.

During the whole of the survey no fatal illness or accident occurred, and such was the personal popularity of the two chiefs that no extra inducement, such as increase of pay, was ever necessary to get men for the survey parties. The trouble was to pick who was to go.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: We are met to-night to hear an account of work done rather long ago—that is, before the War—but of which no general account has been given to this Society or, I believe, publicly at all in this country. I refer to the laying out of the boundary of Alaska, the boundary between British and American territory. It was laid out along a meridian line, as not uncommonly happens in the New World, that is to say, it was drawn straight with the ruler. I believe the lecturer will tell you that that, odd and unnatural as it may appear, was the best and almost the only way in which the boundary could have been laid out, a good deal of the country being practically without any outstanding feature. Major Nesham was concerned in demarcating that boundary, which had been delimited by the report of the Commission. He is to conduct us from the Pacific Ocean on the south to the Arctic Ocean on the north. He has had very considerable experience of those northern regions of which we heard a good deal not long ago in Mr. Lambart's paper on the ascent of Mount Logan, and he will take us over something of the same ground. Furthermore, he has had the opportunity of studying the very remote Eskimo who wander in that country. I will ask Major Nesham to give us his account of a most interesting region very ill-known to most here, as it is to myself.

Major Nesham then read the paper printed above, and a discussion followed.

Sir REGINALD TOWER: All that has been told us in the lecture to which we have listened with so much interest this evening is quite new to me and probably to most of those present. I can add very little to what has been said; in fact, I can only go upon what happened before the survey was undertaken. The little that I have had to do with the Alaska boundary consists of three parts: First, when I was in the Embassy in Washington I was attached in 1898 to Lord Herschell's staff on the Joint High Commission which met in Quebec, where we remained for a couple of months with the Canadian Ministers and several distinguished Americans forming the Commission; among whom were Mr. Fairbanks, afterwards Vice-President of the Republic, Mr. Foster, Mr. Coolidge, and other distinguished Americans. Lord Herschell had as his colleagues the Canadian Ministers, headed by Sir Wilfred Laurier. We sat in Quebec during the summer, and when it became cold we adjourned to Washington. The work went on there for a considerable time until, unfortunately, the proceedings terminated by Lord Herschell's much-regretted death. That was in 1898, and in the following year, when Lord Pauncefote (Sir Julian Pauncefote as he then was) was summoned to the Hague to take part in the Tzar's Disarmament Conference, I was left to draw up something in the shape of a temporary settlement, because the condition of the Alaska boundary between Canada and the United States had become so urgent that there was serious apprehension lest something might occur between the people on the two sides of the line. My work with the U.S. Secretary of State, Colonel John Hay, is something I can never bear sufficient testimony of gratitude for, because when I first went to him he said, "This is a very urgent matter. We must make something in the shape of a temporary line, and at once. We must not have any interruptions; we must do it as quickly as we possibly can. I therefore hope that you will come to my house whenever you like. Come in the evening after office hours, and let us begin at once." That is, I think, a model for Secretaries of State. His courtesy was such as I have never experienced either before or since. The line was drawn in an arbitrary way, chiefly dealing with the southern part that has been shown us on the map, where the greatest danger was likely to be experienced. That formed the *modus vivendi* which was signed in Washington and which, as far as my memory serves me at this moment, stood until the Alaska Boundary Tribunal was formed and sat in London. Again I was appointed as Secretary, and therefore was able to see and know all that was going on in this Commission, being appointed by the two sides, the British and the Americans.

I well remember that the first incident which occurred which seemed likely to injure the good relations between England and the United States was that I had been instructed to have printed on the official notepaper "Alaska Boundary Tribunal." The Americans sent for me and said that the designation was wrong; that it was "Alaskan Boundary Tribunal," the Alaskan being an adjective. I submitted this to the Foreign Office, and they said, "No, its name is 'Alaska Boundary Tribunal,' and so it must remain." The result was that, as Secretary of the Tribunal, when I reported to the Foreign Office it was the Alaska Boundary, and when I reported to the Americans it had to be Alaskan Boundary, and thus both were perfectly satisfied.

I can only now be proud of having played a little part in the matter. The Award of the Tribunal was made; that was embodied in the Treaty, and it is the Treaty which formed the line which we have seen this evening, with those dreadful mountains and difficult country through which our lecturer has taken

us. All I can say is that if I had to work in that connection again I would rather do the job that I had in London and Washington than go over those precipitous mountains, even with the interest that such a journey must have had. I thank the lecturer very much, and I am sure that would be the wish of others, for the interest he has given us in his lecture this evening.

Capt. H. W. SETON-KARR: It may interest this audience to know that about forty years ago I made the first attempt to ascend Mount St. Elias. I was accompanied by Lieut. Schwatka (late U.S. 9th Cav.) and Professor Libby (afterwards the Secretary of the American Geographical Society). It was then thought to be the highest mountain in North America. Our cook was a man called Dalton, who afterwards discovered the pass into the Yukon, since called Dalton's Pass.

The PRESIDENT: As there are no other speakers, I have only to convey to Major Nesham, in your name, your very cordial thanks for the interesting evening which he has given us. I said at the outset that the country was very ill-known to me—how ill-known I have learned as the paper went on; for I must admit that almost every picture was a surprise. I do not know whether it was an equal surprise to you that the country to the north, on the Arctic Ocean, should appear to be much more possible for human habitation than that in the south on the Pacific. I think you all must have appreciated the enormous amount not only of physical labour that was involved in the demarcation of the boundary but also the immense amount of organization necessary to convey a party of that size through the country. More people were probably moving in that survey party than ever moved together in the country before. I wish Major Nesham had shown us rather more of the Indians and Eskimo, of whom, I believe, he has made a special study; but perhaps he will do that for us on some other occasion. At any rate, I offer our cordial thanks to the lecturer.

A LOCAL SUBSIDENCE OF THE GULF COAST OF TEXAS

Douglas W. Johnson and Wallace E. Pratt

IN 1917 a prolific oilfield was developed near the mouth of Goose Creek, a small stream flowing into Galveston Bay not far from Houston, Texas. During 1918 and subsequent years millions of barrels of oil were removed from beneath the surface of the Goose Creek area. Beginning in 1918, it became apparent that Gaillard Peninsula, near the centre of the field, and adjacent low coastal areas were becoming submerged. Elevated plank roadways or walks were built from the mainland to the derricks, and the derrick floors had to be raised. Vegetation was flooded and killed, and finally all of the peninsula disappeared beneath the waters of the bay.

Along the northern and southern margins of the oilfield cracks appeared in the ground, sometimes running beneath houses, across streets, and through lawns and gardens. These cracks persisted, and recurrent movements along them resulted in dropping the surface of the ground on the side of the cracks toward the oilfield. The total maximum

subsidence is now more than 3 feet, and the area affected $2\frac{1}{2}$ miles long by $1\frac{1}{2}$ miles wide, the longer axis running approximately east-west.

In America submerged lands belong to the State, and only the State can grant oil and gas leases on such lands. Consequently, when Gaillard Peninsula became submerged, the State claimed title to it and sought not only to dispossess the owner and the oil and gas lessee, but also to recover from them the value of the oil and gas removed from the premises subsequent to the time when the land became submerged. The question was taken into court, and in the final decision the claim of the State of Texas was denied. The basis for the decision was the court's acceptance of the contention that the subsidence at Goose Creek was not the result of natural processes, but was caused by an act of man, namely, the removal of large volumes of oil, gas, water, and sand from beneath the surface. No act of man can operate to deprive another man of his property under the law. If the subsidence of Goose Creek had been a natural process, "an act of God," then under the American law title to the submerged land would have passed to the State, and property worth millions of dollars would have been lost to the owner of the land and to the operating companies. As it is, the owner and operators continue to enjoy the rich returns from this important oilfield.

Inasmuch as subsidence of the Earth's surface due to the exploitation of oilfield appears to be an extremely rare occurrence, if indeed the Goose Creek case be not unique in scientific literature, and further, inasmuch as the Goose Creek case affords an excellent illustration of the solution of an important legal controversy by the use of geologic and physiographic data, a brief statement of the essential facts may be in order. The senior author was retained as consulting physiographer in connection with the court proceedings mentioned above, and studied the phenomena of subsidence in the Goose Creek region. The junior author's acquaintance with the region was gained in his capacity as Chief Geologist of the Humble Oil and Refining Company, lessee of Gaillard Peninsula.

The geological formations involved are relatively recent, mostly Oligocene or later, and consist of loose sands and clays only slightly more compacted than sea-bottom muds. All of the sand layers are lenticular in shape, and occur isolated in the clays, so that oil or water does not pass readily from one sand-bed to another. Some oil is encountered at a depth of 500 feet below the surface; but the bulk of the production is from depths of 1000 down to 4100 feet. It is important to note that the Goose Creek field does not appear to be located on a salt dome of the ordinary type. No salt has ever been encountered in drilling, although centrally located wells have reached depths greater than 5000 feet.

Numerous benchmarks were established throughout the Goose Creek region some years ago, and these have been re-surveyed and new bench-

marks established at intervals since the original survey. We thus have precise figures showing amounts of subsidence at something like eighty points in the affected area and its immediate vicinity. Sufficient accurate data are thus available to show clearly the essential fact that a local "dishing" of the Earth's surface has occurred in the Goose Creek region, the central area of greatest subsidence corresponding approximately with the centre of the oilfield.

The disturbance certainly has no connection with the supposed gradual subsidence of the Atlantic and Gulf coasts which many geologists and laymen believe to be in progress. General changes of level affect large areas rather uniformly, and, so far as known, never show such sharp differences of rate of sinking within short distances as characterize the Goose Creek region. The greatest rate of subsidence admitted by most geologists for the East Coast of North America is 1 or 2 feet per century; whereas the sinking at Goose Creek has amounted to more than 3 feet in eight years. The surveys demonstrate that the disturbance at Goose Creek rapidly dies out to nothing in all directions from the centre. These facts show how impossible it should be to confuse the sinking at Goose Creek with the phenomena of general coastal subsidence.

The Goose Creek disturbance is equally unrelated to the rise of mean sea-level observed at Galveston by the United States Coast and Geodetic Survey, and amounting to about 6 inches in the period 1917-1923. W. B. Dawson, of the Canadian Tidal Survey, and G. T. Rude, of the U.S. Coast and Geodetic Survey, have shown that mean sea-level may vary from year to year by an amount which sometimes exceeds a foot. These changes are due largely to meteorological and astronomical causes, and occur in cycles of several years' duration. The senior author of the present paper has shown that mean sea-level may also change with changes in the form of the shore-line, natural or artificial changes in the size of inlets, deepening of channels into bays, and other alterations of a local character. Careful study of the conditions at Galveston would probably indicate that the changes reported there are of a temporary nature. In any case, the reported change in sea-level at Galveston is so small as compared with the changes at Goose Creek as to make clear the fact that they are not related. Furthermore, it should be noted that since all measurements in the Goose Creek area are referred to fixed benchmarks on the land, and not to tide-gauges recording mean sea-level, the changes at Goose Creek are not only independent of, but are in addition to, any supposed changes indicated by the Galveston records. The Goose Creek sinking certainly has nothing to do with any real or apparent changes in the average level of the sea.

Erosion of clay coasts by waves or currents frequently produces local subsidence, with cracking and displacement of the surface far back from the actual shore. The Goose Creek disturbance clearly has no relation to such a process. The fact that the subsidence is distributed indifferently

over both land and water areas, and that low marshland on Gaillard Peninsula has suffered equally with the higher clay uplands, is against the wave or current-sapping theory. If any subsidence were to occur in this region due to wave or current action, it should be along the more exposed neighbouring shores where conditions are in all respects more favourable ; but no such changes of level are known in these areas.

The Goose Creek depression cannot reasonably be interpreted as a sink-hole formed by the solution of limestone, salt, or other soluble formation in depth, under natural conditions. Neither limestone nor salt is encountered in the drilling of the wells. If the Goose Creek oilfield is developed over a salt dome, the salt occurs at depths greater than 5000 feet. In any case, the solution theory can be applied, if at all, only by recognizing that artificial exploitation of the oilfield brought about conditions favourable to rapid solution, as by creating a vigorous circulation of water which did not previously exist.

In our opinion the cause of the subsidence is to be found in the extensive extraction of oil, water, gas, and sand from beneath the affected area. The purely local character of the disturbance, the facts that the area of subsidence coincides with the period of extraction, and that continued extraction is accompanied by continuing subsidence as shown by the latest measurements, all point unmistakably to this conclusion. These points will be considered in order.

Subsidence is purely local, and its area corresponds closely with the area of extraction. The oil wells cover an area that is rudely oval, with the longer axis east-west ; and the contours of equal subsidence exhibit the same pattern. The centre of maximum subsidence is near the centre of the drilled area. Where groups of wells reach out beyond the average perimeter of the field, there is a distinct extension of the zone of subsidence into the areas of extended drilling. The location of earth fractures near the margins of the field, one on the north and one on the south, with the down-drop in each case toward the centre of extraction, is highly significant.

The time of the subsidence corresponds with the time of extraction. Prior to the development of the oilfield in 1917 no indications of subsidence appear to have been noted in this area. Then came the opening of the oilfield, and a year later the subsidence became evident. In eight years the change of level amounted to 3 feet. A closer coincidence between time of subsidence and time of extraction could not be imagined.

Continued extraction is accompanied by continuing subsidence. This is made apparent by recent surveys. In the year 1924-1925 the maximum subsidence was 0.25 foot near the centre of the field, the amount decreasing outward in all directions until areas of absolute stability were found about the margins of the affected district.

It is safe to say that the aggregate volume of oil, gas (at 1000 lbs. per square inch pressure), water, and sand removed from Goose Creek since

1917 will exceed 500,000,000 cubic feet. This is several times greater than the calculated volume between the planes representing the present surface and the former surface of the Goose Creek field. In other words, the cause seems amply sufficient to account for the observed result.

It has been noted that the coastal plain beds at this locality consist largely of unconsolidated clays, and that the oil sands occur in discontinuous lenses. Under such circumstances the removal of oil and water from the sands is not followed by a free flow of water into the pore spaces from distant localities, because the compact nature of the clays, which completely surround and isolate the sand lenses, prevents such ready flow of water. The pore spaces are therefore occupied by water draining in more slowly from the adjacent clays; and it is a well-known fact that the draining of clays causes them to become more compact. This, in turn, would permit subsidence of the overlying surface. Other important factors, undoubtedly, are the reduction of pressure in the sand reservoirs from values of 1000 or 1200 lbs. per square inch to atmospheric pressure, and the actual removal of sand itself from the reservoirs. In the reduction of moisture content, escaping gas has been of material importance. These factors have combined to produce a draining and a drying of the clays, with consequent shrinkage; and in the absence of competent beds to support the overlying deposits, the results have become apparent in a remarkable dishing of the surface in the Goose Creek field.

THE MILITARY GEOGRAPHICAL INSTITUTE OF CZECHO-SLOVAKIA

Major M. N. MacLeod, D.S.O., R.E.

THE opening of the new offices of the Military Geographical Institute at Prague last year is an event in the history of European geography and cartography which may serve as the occasion for a short account of the aims and accomplishments of the youngest of national survey departments. Founded in November 1918, the Institute has had many difficulties to surmount. Before the Great War all the cartographic services of the old Austrian Empire were concentrated in Vienna, and the new republic, when it came into existence, found itself nearly destitute of material from which to construct its national survey department. No machinery or equipment whatever was available, nor any suitable building, while trained technical personnel was very scarce.

The first quarters of the Institute were a private house at Ujezd. From this it moved in 1919 into the Budovec School, and soon afterwards into some buildings in the old Arsenal. These were quickly outgrown, and in 1921 the Institute overflowed into the Stefanik barracks at Smichov. Meanwhile, new offices had been under construction, and were ready for occupation in 1925. The Institute, after its many flittings, is at last

permanently housed in a specially designed building which should excite the envy of its more mature cousins in older countries.

Occupying an area of 4600 sq. metres, the new building provides on ground floor and four stories, 20,000 sq. metres of useful floor space. The printing offices, included in the above, are in a separate *annexe* in the courtyard, an arrangement which frees the drawing and computing offices, as far as possible, from noise and vibration.

The exterior is plain but imposing, while the arrangement of the interior has evidently been thought out with care; it is claimed that the photographic studio is different from any hitherto constructed, and is superior to that of the Institute at Vienna. A room for geophysical measurements, completely isolated and equipped with arrangements for maintaining a perfectly uniform temperature, has been provided in the basement.

The Institute is at present directed by Col. Karel Rausch, and is organized in seven sections, as follows: Astronomy and Geodesy (Lieut.-Col. Dr. Ladislav Beneš); topography (Col. Alois Hlíděk); cartography (Lieut.-Col. Matěj Semík); reproduction (Lieut.-Col. František Kostrba); military statistics (Col. Jiří Čermák); administration (Lieut.-Col. Rudolf Krčmář). There is no separate section for levelling, which is included in the work of "Astronomy and Geodesy."

The data and map material with which the Institute now deals are of course inherited from the old Austrian Empire. The surveys were executed more than forty years ago and are now seriously out of date, more especially in the industrial regions, where changes have been greatest. For the Czecho-Slovak republic the problem of maintaining an adequate revision of the national maps on a strictly limited budget is at present complicated by the fact that all the names on the old Austrian maps were either Germanized or Magyarized. There is a very natural desire to restore them to their native Czech as soon as possible, and without necessarily waiting for the sheets to be revised in the field. This is very largely a question of cartography and reproduction, and the Institute is to be congratulated on the progress made in spite of the severe handicap imposed by its numerous moves before settling into its present quarters.

No attempt has been made to alter the sheet lines of the old Austrian Series, though at some time or other this may have to be done, as the large-scale sheets are on a polyhedric projection, and therefore not adapted for "gridding" on the rectangular system demanded by the modern soldier.

Five separate series of maps were taken over from the Austrians at scales of 1/25,000, 1/75,000, 1/200,000, 1/300,000 and 1/750,000. In addition to maintaining these series, either by revision or redrawing, the Institute has in hand some 1/10,000 and larger scale work, and two sheets of the "Carte Internationale du Monde" (N.M.33 & 34). It proposes also to commence shortly a new map of the whole country on Lambert's.

projection (presumably Lambert's Conical Orthomorphic) on a scale of 1/500,000. This map will replace the present 1/750,000, which is regarded as provisional. It is the old Austrian Staff map on Bonne's projection, and covers the territory of Czecho-Slovakia in nine sheets. It is being published now only in semi-skeleton form without contours or hachures.

Considerable changes, very much for the better, are being made in the large-scale maps. On the 1/25,000, in addition to revision of names, the sheets are being redrawn and published in two colours. On the new sheets the old black hachures are replaced by brown contours at 5-metre intervals with every fifth contour thickened. The new 1/75,000 differs less from the old in that hachuring is retained for the ground forms. The map is printed in one colour only, water and lakes being shown by "waterlining." The drawing of this and the ornament—in fact, of the whole map—is beautifully done, and the reproduction—apparently by photo-etching—is admirable. These new sheets of the 1/25,000 and 1/75,000 are excellent maps of which the Institute may well be proud.

The 1/200,000 series is not so satisfactory. It is printed in four colours, hill features being shown by brown hachures. The reproduction is very good, but the sans-serif type used for the names is not beautiful, and the map is, in places, inclined to be overcrowded.

As regards field work, good progress has been made with the revision on the scale of 1/25,000, and certain small areas are being, or have been, surveyed on a scale of 1/10,000. Other large-scale surveys are projected. An interesting feature of the field work is the use which has been made of photogrammetry. A photogrammetric "Brigade" was formed in 1923, and some statistics of the results of its work are given in the Annual Report of the Institute for 1925.

In one case, in close gently undulating country, the out-door work (including triangulation) for a 1/10,000 survey of 36 sq. kilometres took 35 days, and the office work (using the Stereoautograph) 124 days. It is estimated that the total time of 159 days in this case is no less than would have been required for an ordinary traverse survey. In another case, where the ground was much accidented, the out-door work required 54 days and the office work 97 days: a total which is estimated to be two months less than would have been required by other methods. Some emphasis is laid on the importance of doing photographic surveys as far as possible in winter when the trees have shed their leaves.

The conclusion is that the value of photogrammetry depends on the amount of relief, on the visibility, and on the scale. It is considered that photography in close gently sloping country is useful only for very large-scale work. This is probably correct as regards photography from ground stations, but it is precisely in such country that the value of taking the camera into the air is likely to be most apparent. The Institute does not yet seem to have made any use of aerial photography, but it

evidently hopes not only to do so, but to effect substantial economies in the cost of revision by this means. Whether this hope will be realized remains to be seen. Reports of any work of this kind which may be done by so practical and enthusiastic a staff will be read with interest in this and other countries.

THE JUBILEES OF THREE GEOGRAPHICAL SOCIETIES

THE year 1926 has been prolific in Jubilees of our sister Societies. In March the Real Sociedad Geográfica of Madrid celebrated its fiftieth anniversary (*Geogr. Fourn.*, 67, 553), and in November the three Societies of Antwerp, Brussels, and Copenhagen. Our Society was represented in Belgium by one of its Vice-Presidents, Lieut.-Col. Sir Francis Younghusband, and in Denmark by one of its Honorary Secretaries, Colonel-Commandant Jack. We are indebted to these representatives for the following brief accounts of the proceedings.

The celebration of the Antwerp Society was held at Antwerp on Saturday, November 6. A large meeting was held in the afternoon at the Opera House with Maître de Cock, the President, in the Chair. He delivered an eloquent address welcoming the delegates from the different Societies and setting forth the main activities of the Society during the fifty years of its existence. General Gouraud, representing the Société de Géographie of Paris, gave a history of French colonization in North and West Africa since 1876. Sir Francis Younghusband followed with a description of British colonial expansion in South Africa, and Colonel Liebrechts completed the story with a description of Belgian activity on the Congo. At the close of the proceedings General Gouraud was made an honorary member of the Society (he already had received the Gold Medal), and Gold Medals were conferred upon Colonel Liebrechts and Sir Francis Younghusband. Every delegate was presented with a beautifully illustrated catalogue of Belgian cartography in the sixteenth, seventeenth, and eighteenth centuries. In the evening a banquet attended by about 400 members and delegates was given, and was attended by the Prime Minister of Belgium, the Minister of the Colonies, and the President of the National Bank. At the banquet Sir Francis Younghusband presented an address of congratulation from the Royal Geographical Society.

On Sunday, November 7, the Royal Geographical Society of Brussels celebrated the fiftieth anniversary of their foundation. A general meeting was held in the afternoon, at which the President of the Society delivered an able address summarizing the geographical results of the last fifty years. Addresses of congratulation were then delivered by the

delegates of other societies. At the invitation of the Society Sir Francis Younghusband gave an account of his mission to Lhasa in 1904, and was offered the distinction of "Membre d'Honneur" by the President. In the evening the delegates were entertained at a banquet by the Society, and later in the evening a reception was given by Baron Lambert.

Owing to the marriage of H.R.H. the Crown Prince during the same week, the King of the Belgians was unable to honour either the Antwerp or the Brussels Society with his presence. But His Majesty, before the Royal wedding had been fixed for the week already settled upon for the Societies' celebrations, had expressed his intention to be present and his cordial interest in the proceedings.

To the celebrations at Copenhagen Norway, Sweden, Finland, Germany, Spain, and Great Britain had sent special delegates. The proceedings began at 1.30 p.m. on November 17 with a meeting at the University. After a short address of welcome by the President of the Royal Danish Geographical Society (Vice-Admiral Wandel), the foreign representatives and various local representatives of the University, scientific societies, etc., in turn offered the congratulations and compliments of their respective Societies. After this the President announced that the Danish Society desired to make all the representatives of other Societies who had done them the honour of attending the celebrations, Honorary Members of their Society; and diplomas conferring Honorary Membership were then presented to the representatives. The proceedings terminated with a lecture by Prof. Vahl on "The participation of Denmark in Arctic Explorations."

In the evening a banquet was given to the foreign representatives and other visitors at the "Royal Skydebane," the headquarters of a shooting club which has been established for over 170 years, and in which the custom is that the winner of the annual shooting competition shall have a picture painted on his target, which is then hung in the building. The walls and some of the ceilings are covered with these targets, dating from 1752.

On the 18th the visitors were conducted to the famous collections of Egyptian, Greek, and Roman antiquities in the Glyptotek, and at 7.30 there was a large meeting in the Oddfellows' Hall, at which the King and the Royal Family were present. Before the meeting His Majesty received the foreign delegates, and desired them to convey to their respective Societies his personal thanks for their attendance.

At the meeting the President gave a short address of welcome; the Secretary, Major-General Castonier, related the history of the Society; and Dr. V. Madsen gave an address on "The Evolution of Greenland," illustrated by lantern slides and moving pictures. After the meeting the visitors and ladies of the Society were entertained at supper at the Hotel Phönix.

THE VEGETATION OF NORTH AFRICA

Carte Phytogéographique de l'Algérie et de la Tunisie, publiée par ordre de M. Maurice Violette, Gouverneur-General de l'Algérie. Notice par le Docteur René Maire, Gouvernement General de l'Algérie. Service Cartographique. Alger: Baconnier Frères. 1926. Pp. 78. *Coloured Map on scale of 1 : 1,500,000. Sixty Illustrations.*

THE title of this publication does not give a wholly adequate impression of its contents. The map is in the pocket of a bulky pamphlet which contains a discussion of the principles upon which it is based; an account of the flora of the area represented; a bibliography; and a long series of illustrations which, though not well reproduced, are of great interest and bring out admirably the outstanding features of the vegetation. More emphasis might, we think, have been laid upon the text, so briefly dismissed on the title-page, for the map is by no means self-explanatory. For example, an almost continuous coastal strip from the west of Bizerta to far to the west of Bougie is indicated as being occupied by the cork oak, while a somewhat narrower inland belt, including the singularly treeless area round the town of Constantine, is coloured with the light green tint which marks the holm oak formation. Generally, those familiar with the area represented will find difficulty in reconciling the facts as they saw them with the map, and others might be led seriously astray. We must confess indeed to a fear that the map may be reproduced in diagrammatic form in text-books and atlases, and give rise to quite false impressions as to the forest resources of the region. In the opening paragraphs of the text Dr. Maire explains the origin of these apparent anomalies by setting forth the purpose of the map. The aim which has guided him and his collaborators, he says, is to indicate the vegetation which would have normally covered the soil if nature had been allowed to work unimpeded, without direct or indirect interference by man. The map is stated to represent the broad lines of "climatic vegetation," that is, vegetation as influenced by the climatic factors. The point is illustrated by a discussion of the conditions in the Mitija plain. At the present time that plain is occupied, almost throughout, by cultivated crops; but an examination of small areas which have remained almost untouched by man, and of the floral succession in areas allowed to relapse from cultivation, lead him to believe that it was originally covered with low forest with wild olive and *Pistacia lentiscus* as dominants. In consequence, on the map the cultivated plain is marked as occupied by this formation. The map, in other words, represents deductions and not facts of observation.

Whether the working out of such a scheme on a small-scale map is possible in an area where man's influence has been so prolonged and so great is perhaps a question for the botanist; we need only note in passing that the author's illustration appears to evade some of the problems concerned. The present cultivated crops of the Mitija are of very recent origin, and the difficulty in tracing the antecedent vegetation cover is thus small. But some have thought that the presence of wild olive and lentisque in Algeria is a proof that there was a still earlier type of cultivation, including the characteristic Mediterranean fruit trees, that is, that the olive-lentisque formation itself is a secondary and derivative one and not primary. When the author speaks of "quelques coins privilégiés ayant échappé plus ou moins à l'action de l'homme" here he seems to have in mind man during the period since the French occupation, and to leave out of account possible earlier human influence. Without attempting to elaborate such points we feel it necessary to emphasize the fact that there

is nothing on the map itself to indicate that the colouring is not a guide to existing conditions, and that therefore it should not be used without a previous careful study of the text.

The main value of the map to the geographer is necessarily that it emphasizes the influence of the broad climatic factors, especially the rainfall conditions, and that, assuming that the limits drawn for the different subdivisions are "natural" and not excessively generalized, it serves to supplement the available climatic statistics. In the text there are a number of interesting notes on the possibilities of economic utilization of the areas marked as occupied by the different formations.

The area mapped is divided into two regions, the Mediterranean and the Sahara. The latter is however practically not discussed, and is left chiefly blank on the map. The Mediterranean Region is subdivided into three Domains. Of these the first, the Mauritanian Domain, is characterized "climatically" by the development of forest. It is subdivided into five Sectors, chiefly on the basis of differences of rainfall. The best-watered section is the Numidian, consisting of a small part of the north coast of Tunisia and of that of Algeria to a point some 50 kilometres east of Algiers. This is characterized, at least in theory, by the enormous development of the cork oak, and is in sharp contrast to the Public Section in north-east Tunisia, where *Zizyphus lotus* is characteristic, and the flora has a strong eastern element.

Into (2) the Mauritanian Steppe Domain falls the inland area with a continental climate and a small and irregular rainfall. A number of sections are again recognized. The general feature is that the climate is not well suited to forest growth, "which has taken refuge in the relatively well-watered mountain areas, where it is represented only by types requiring little water and heat." In (3) the Domain of the High Atlantic Mountains is included the region where elevation increases rainfall, while at the same time the temperature conditions exclude the more delicate forms. The most striking tree is of course the Atlas cedar, but this is accompanied by a number of endemic forms and by many interesting "relict" plants from the cool temperate zone.

In addition to showing the limits of the different domains and their subdivisions the map indicates the distribution of fourteen plant formations. It is interesting to note that no less than twelve of these have trees or shrubs as dominants. Of these twelve, again, seven have broad-leaved trees or shrubs as dominants and five gymnosperms. Among the broad-leaved trees the oaks give their names to three separate formations, that of *Quercus ilex*, that of *Quercus suber*, a tree always tending to disappear, and that of the deciduous forms, *Q. afares* and *Q. lusitanica*. So far as actual area is concerned, even on the method adopted, the regions occupied by such true forest trees are much smaller than those characterized by straggling scrub forms such as *Zizyphus lotus*. Thus the attempt to ignore human influence but emphasizes once again the fact that in regions of Mediterranean climate high forest appears to maintain itself with difficulty. If man's influence had been taken into account many of the forest areas marked on the map would have been so reduced as to have disappeared from a map on this scale. No indication is given on the map of the effects of the attempts at afforestation, and thus neither map nor text offers any contribution to the interesting problem of whether the decaying condition of Mediterranean forests is due in part to the fact that the number of species available for recolonization after the Ice Age changes of climate was much smaller than in Eastern Asia and Eastern North America, or whether present climatic conditions alone are responsible. It may, however, be noted

that to the visitor to Algeria to-day the woods formed of trees introduced from other parts of the globe seem a more conspicuous feature of the landscape in many places than those which figure in vivid tints on Dr. Maire's map.

The colouring of the map is somewhat crude, and the author has apparently found it impossible to carry out consistently any sort of "naturalistic" tinting. Thus, while green shades are used for the three oak formations, blues are used both for formations with conifers as dominants and for the mixed deciduous woods composed of elm, ash, etc., and there are other similar anomalies which make it difficult to grasp the map as a whole. But it is of course possible that this is intentional, and is intended as a hint that the scheme is purely theoretical and not an attempt to represent existing conditions. M. I. N.

REVIEWS

EUROPE

Cambridge Past and Present.— Brian W. Downs. Illustrated by E. Vulliamy. London: Methuen. 1926. 9 × 5½, pp. vii. + 257. *Sixteen Illustrations in Colour.* 15s. net.

MR. DOWNS' book supplies several needs in reasonable compass. It is at once a history of the town, University, and colleges, a guide to the buildings of note and their contents, an introduction for the uninitiated to the customs and procedure of University life, and a commentary upon the latter, lively and humorous, which will appeal also to Cambridge men. In his treatment, which avoids becoming either tedious or scrappy, he has struck out a line which might well be followed by other "guides, philosophers, and friends," though they will not all achieve his success. As an introduction to Cambridge it would be difficult to improve upon this book, and its value is further heightened by the set of effective illustrations in colour.

The Place Names of Bedfordshire and Huntingdonshire.— A. Mawer and F. M. Stenton. (English Place-names Society, vol. 3.) Cambridge University Press. 1926. 9 × 6, pp. xlii. + 316. *Two Maps.* 18s. net.

This volume of the English Place-names Society equals in interest those previously published. Though the area covered has not a striking history, the work shows how a careful examination of the place-names, if it cannot bring out fresh facts, will corroborate results in other fields. The West Saxon conquest of the Ouse basin from the Middle Thames is placed at a comparatively late date: partly from the existence of an extensive and locally developed topographical term, "hoh," hill-spur. This late conquest may be accounted for by the former forests of the plains, for which there is evidence in the names. The theory of a British survival in the Fens receives no support. Interesting light is thrown upon the origin of the four names for the Roman roads: Icknield Way, Watling Street, Ermine Street, and Akeman Street. In all cases it is shown that these names were first applied to a limited portion and afterwards became used for the whole length of the road. Thus Watling Street is derived from the tribe of the Waclingas, the settlers on the site of Verulamium (Waclingaceastir). Similarly Ermine Street, with Armingford Hundred, derives from the ford across the Cam, known as Earningaford from the tribe of the Earningas.

Unknown Brighton.— George Aitchison, with Illustrations by Stella Langdale. London: John Lane. 1926. $7\frac{1}{2} \times 5$, pp. xiv. + 166. 7s. 6d. net.

Mr. Aitchison is right: too much is made of the Brighton of the Regency days to the exclusion of the shadowy far-off things and even of the picturesque, the mysterious, and the romantic things of to-day. He has set his text admirably in tune with the suggestive—if somewhat sombre—aquatints of the artist: “St. Paul’s,” “Little East Street,” and the “Lanes” are, we think, the kind of subject she treats most effectively. The author writes very pleasantly, loves a good story, and can “write up” skilfully any odd little episode which has attracted him. The mere breath of rumour, a faulty etymology, a word or two with an archæologist will set him talking, and his discourse is in a light, whimsical vein. Like his illustrator, he is best when making romance out of the “Lanes,” neglected by Erredge and Bishop, that part of Brighton which is the town’s most picturesque and most distinctive heritage, its nucleus of artistic and historic interest. It is his merit that he opens up, or rather gives us a momentary peep into, many fresh vistas. It is refreshing to be reminded of prehistoric and Roman Brighton, of the Saxons landing on its beach, of French raids and Brighton pirates, of the devastating storm of 1703, and of the lost river which once meandered down the Steyne. It is to be hoped that many lovers of Brighton will sail with the author his “uncharted seas,” even though the trip be of the “Skylark” order. S. E. W.

River Thames from Source to Mouth.— F. V. Morley. Illustrated by Laurence Irving. London: Methuen & Co. 1926. 9×6 , pp. xi. + 255. *Sixteen Plates in Colour and Maps.* 16s. net.

That the Thames for the greater part of its course flows through rural England, beyond the domains of industrialism, and that its valley was once a main artery of English life, are fortunate facts for the holiday-maker—they spell pleasant surroundings and rich memories of the past. And then there is the lively contrast of the life of the estuary. Mr. Morley has well utilized these circumstances. The greater part of his book consists of the literary associations of river and river-side towns, a wide field from which he has gathered lesser-known passages. His quotations are attractive and varied, and he makes the most of the opportunities, not limited to the more obvious ones presented by Oxford, Windsor, or London, for example. He also refrains from quoting Wordsworth or referring to Whistler. Into these literary and historic threads, he has woven a narrative of a voyage down the river in the “Wife of Bath,” and a suggestion of a treasure hunt. The advantages of combining these elements into one book may be doubted, but at any rate there is something here for all tastes, without reckoning the sixteen pleasant water-colour sketches by Mr. Irving.

La Montagne Noire (Aude, Hérault et Tarn). *Essai de Monographie Géographique.*— André David. Préface de Emm. de Martonne. Dessins de Léo David. Carcassonne: L. Bonnafous. 1925. $10 \times 7\frac{1}{2}$, pp. 226. *Illustrations, Diagrams, and Sketch-maps.*

This pamphlet is the work of a brilliant young student of geography who lost his life in the war. The Montagne Noire, that south-western buttress of the Central Plateau which pushes out towards the plain, and marks the area of transition between Atlantic and Mediterranean France, was assigned to M. André David in 1913 as a special subject of study for his Diploma. He betook himself to his task with such fervour and success that when his material was presented he was urged to complete and elaborate it as a thesis for the

doctorate. The war made this impossible, and his family and friends have prepared his material for posthumous publication in order that the results of his labours should not be lost. The region is one of great interest, alike from the morphological and vegetational standpoints and from that of human geography. It retains certain primitive features, notably in regard to its local industries, of which a full historical account is given, while its agriculture is particularly interesting both because of the blending of crops characteristic of the Mediterranean and Oceanic climatic types respectively, and because of the changes which are taking place at the present time. All these aspects are treated fully and in careful detail, and the booklet will prove of great value to students of the regional geography of France. M. I. N.

A Cruise upon Wheels.—The chronicle of some autumn wanderings along the deserted post roads of France. Charles Alston Collins. With Illustrations by Andrew Johnston. London: Peter Davies, Ltd. 1926. $8\frac{1}{2} \times 5\frac{1}{4}$, pp. xi. + 484. 10s. 6d. net.

This is a reprint of a work first published in 1862 by a son-in-law of Charles Dickens, in which a journey by cabriolet from Calais to Geneva is described. In the preface the author claims to have made a new discovery—the plan of writing “the history of a journey in which the interest attaches more to the persons who travel than to the places which they travel through.” If this claim is justified, then this is the first of a very considerable species of travel book in which the reader is treated to facetious accounts of the doings of “fictitious characters” abroad. The author has been uniformly successful in avoiding dwelling too much upon the passing scene—he has not been, in his own words, to the Encyclopædia to “fish out half a hundred or so of ancient legends”—though a table of distances and expenses brings up the rear. Some readers, however, will find entertainment in this mildly Dickensian and long-winded account of the adventures of Mr. Fudge and Mr. Pinchbold.

ASIA

The Geology of the Netherlands East Indies. Lectures delivered as Exchange-Professor at the University of Michigan in 1921–22.—H. Albert Brouwer. Recorded and prepared by L. M. Gould. New York: The Macmillan Company. 1925. $9\frac{1}{2} \times 6$, pp. xii. + 160. *Eighteen Plates*. \$3.

Notes on the Morphology and Tectonics of the North Coast of New Guinea.—J. Zwierzycki. *Philippine Jour. Sci.*, vol. 29, No. 4 (Manilla, April 1926), pp. 505–513; 3 *Plates*.

The Eastern Archipelago as the link between Asia and Australia and containing the easternmost end of the fold mountains of the Alpine-Himalayan System is of special geographical interest. The literature of the Dutch East Indies is scattered, and Michigan University has earned the thanks of physical geographers by publishing Prof. Brouwer's brilliant summary of the evidence in his lectures as Exchange Professor. The volcanic and earthquake belt of the Dutch East Indies is especially instructive. Many of the volcanoes, according to Prof. Brouwer, were once larger and more powerful, as cauldrons have been formed by the collapse of volcanic cones. Some of the eruptions are of the Peléan type, and clouds of incandescent volcanic ash, which Prof. Brouwer describes as an emulsion of disintegrated volcanic material, have swept down the mountain sides. Earthquakes, which are frequent in the area, have only a secondary connection with volcanic action, and occur chiefly in areas of recent earth-movements. That the crust in the area has long been

subject to great vertical oscillations is shown by the deep-sea deposits in the islands belonging to many geological horizons. They resemble the well-known fossil oceanic deposits of Barbados, and they occur in the Trias, Jurassic, Cretaceous, and Pliocene. The western part of the area is a shallow platform from 40 to 45 metres deep, and Prof. Brouwer regards this "Sunda Shelf" as an old peneplain which has been submerged by a rise of sea-level due to the melting of the ice of the glacial period. This acceptance of Daly's theory contrasts with the account of the raised coral reefs which on the eastern islands occur at different levels and have been tilted, and show that at least the latest interchange between land and water was due to movements of the sea floor. Nansen's explanation of the coastal platform would appear adequate for the Sunda Shelf.

The shape of Celebes is attributed to fractures and vertical subsidences. Prof. Brouwer regards the eastern part of the Malayan arc as being still in process of folding and as moving horizontally at the same time. He regards this fold line as bent round like a crook at the western end, the Kei Islands being in the middle of the bend. It has been previously pointed out (*Geogr. Journ.*, July 1923, pp. 20-30) that the evidence for this crook-shaped fold is inadequate, as the known strikes of the rocks in the Kei Islands indicate, not pressure from the west, but that the islands are a residual arc left by the foundering of the Banda Deep. This view having been suggested before the date of Prof. Brouwer's lectures is not considered; the volume gives further support to it. Thus, instead of Buru, which is at the western end of the northern line, being overfolded from the south, it is overfolded from the north-east; Prof. Brouwer remarks that the Buru line carries on to New Guinea, and that the outside of the Timor-Ceram arc and the strike of the northern Moluccas are continued in Western New Guinea; he remarks, too, that the Kei Islands have a simple structure, whereas if they were part of a reflexed fold-mountain a complex structure would be expected. The Kei Islands moreover are not volcanic, whereas the part of the arc to the west with which they are correlated is the seat of recent volcanic activity. Prof. Brouwer's evidence shows that the view of Neumayr that the Eastern Archipelago was part of an ancient Sino-Australian continent and the later Equinoctia of Abendanon are both inconsistent with the evidence, as the whole region has been one of great and long-continued vertical earth-movements during which some parts of the area have been constantly occupied by the sea.

The little-known Dutch part of the northern coast of New Guinea has recently been investigated by J. Zwierzycki of the Mines Department of the Dutch East Indies, who has published a preliminary account of his observations. Along part of the coast raised coral reefs occur 60 metres above sea-level, while farther east they rise to from 300 to 450 metres. The author remarks that this high level is inexplicable, as there is no evidence of any such general submergence; possibly these higher reefs may consist of older coral limestones, or the uplifts may be local. The coral islands along the coast are thought to rest upon the summits of a sunken chain of mountains. The Kainozoic rocks include foraminiferal limestone and Globigerina marls which probably represent one of the deep-sea deposits known in other members of the Eastern Archipelago. Some active mud volcanoes are attributed by the author to the crushing of the rocks by compression due to earth-movements that are still in progress. The older crystalline rocks are regarded as relics of a ruined Pacific continent. The trend and texture of the mountains are similar to those of the Himalaya and the Alps, and the mountains

have been folded by pressure from south to north as in the Timor-Ceram arc, and that fact strengthens the connection of that arc with the mountains of north-western New Guinea. Probably some problems suggested by Mr. Zwierzycki's interesting preliminary paper will be solved by the promised fuller account of his observations.

J. W. G.

A Book of South India.— J. Chartres Molony, I.C.S. (Retired). London: Methuen & Co., Ltd. 1926. $8\frac{1}{2} \times 5$, pp. xii. + 252. *Sixteen Illustrations and a Map.* 7s. 6d. net.

This is a pleasantly written account of life and work in the Madras Presidency by a recently retired civil servant endowed with humour and geniality: Mr. Molony describes with a facile and light pen his experiences in many parts of this, the senior, presidency, while performing that variety of administrative duties which to many is the charm of work in the I.C.S. We wander in the agreeable company of our author from among the highly intellectual races of the plains country to the wild environment of the Khonds, Mappillas, and Chenchus. We have a frank statement of the genesis of the last Mappilla outbreak; and we see the Chenchu still in a most primitive state—"idle, improvident, drunken, thievish, and brutal," as a public document described him in 1921. In most chapters brief notes of earlier historical events add interest to the narrative. The reader may realize from several of the anecdotes recorded (cf. pp. 36 and 96-97) how fundamentally the Oriental outlook often differs from our own, and how unsafe it is to apply Western criteria to Eastern problems. He will also acquire some conception of the extraordinary diversity of racial type and physical conditions met with in India. Appreciative character sketches have been inserted of some eminent Indians, and a well-deserved tribute paid to the splendid medical work being done by missionary and other organizations.

C. E. A. W. O.

The Epic of Mount Everest.— Sir Francis Younghusband, K.C.S.I., K.C.I.E. London: Edward Arnold & Co. 1926. $8\frac{1}{2} \times 6$, pp. 319. *Sketch-maps and Illustrations.* 7s. 6d. net.

It is well that 'The Epic of Mount Everest' should have been put before the general public in a form more accessible than the substantial volumes which have furnished to mountaineers a detailed chronicle of the three assaults on the great peak. And the Mount Everest Committee are to be congratulated on having found at hand in their first Chairman, Sir Francis Younghusband, a bard exceptionally qualified both by his knowledge of the Himalaya and his enthusiasm for mountain exploration to do full justice not only to the dramatic incidents of the Great Adventure, but also to the spirit that prevailed among those who took part in it. While doing this he has been successful in bringing out the personal traits of many of the leading members of the three expeditions. In his pages we are quickly led to make friends with General Bruce, the jovial leader of the second party, to appreciate the mercurial grace of Mallory, the stalwart strength of Irvine, and the indomitable courage of Odell. We are told a simple tale of amazing endurance, daring, and unselfishness which deserves to be read by all Englishmen, and to be put in the hands of every English schoolboy.

It would have been easy for Sir Francis Younghusband to insist on the gain to physiology resulting from the climbers' experiences as to the capacity of the human frame to undertake strenuous exertion at heights over 24,000 feet. These experiences have effected a reversal of the opinion previously held by all but a few experts—among whom may be named that eminent

surgeon and mountaineer, the late Clinton Dent. Sir Francis might further have pointed out that, as the exploits of De Saussure marked the opening of the Alps to human uses, scientific and general, so the Mount Everest Expeditions indicate the way to further advances in travel and research in regions of the Himalaya less carefully preserved by native prejudices. He might have alleged additions to other branches of science to be drawn from the experiences of our intrepid explorers. But he has wisely wasted no space in combating the pretensions of those who demand of all adventure that it shall be justified by having a "serious scientific purpose." He prefers to look on the story he has to tell as another episode in the long struggle of the spirit of man to obtain mastery over the material forces of the world. He is content to ask his readers to assume that the thirst for discovery, one of the qualities that have gone to create the British Empire, is put to no unworthy use in exploring the secrets and revealing the hidden glories of the Poles or the Himalaya. He might well have taken for his motto the lines of Emerson quoted by an eminent scientist, Tyndall, in his account of the first ascent of the Weisshorn :

" Men in these crags a fastness find
To fight corruption of the mind,
The insanity of towns to stem
With simpleness for stratagem."

In a comparatively small volume Sir Francis Younghusband has been successful in weaving the events of the three campaigns against Mount Everest into a consecutive and engrossing narrative. He has framed the tragic story in a vivid description of the bleak Tibetan landscape and its secluded monasteries with their strange denizens.

To most readers of this *Journal* there will be no need to recall the incidents of the protracted struggle, the close approaches to success, the final catastrophe. But those who have in their time been mountain explorers beyond Europe may be invited by the opportunity afforded by the condensed narrative here put before them to consider what reflections for future use are to be gathered from its pages. Among the more important lessons for Himalayan explorers we should reckon these : that the climbers destined for a final assault *should come to it with powers unimpaired by previous exertions* ; that the staff of porters should be adequate to provision the two highest camps for at least four Europeans, and that one of the latter should be able to converse in Tibetan or Nepalese with their native followers ; that the final camp should be planted not necessarily higher, but nearer the summit than the Camp VI. of 1924 ; that if oxygen is to be used at all—and it would seem to be expedient that a small amount should be at hand to meet a case of emergency—the apparatus for carrying it must be both simplified and materially lightened ; that since a delay at start may make a vital difference in the day's accomplishment, and having regard to the tendency to slackness created by cold and altitude, very special effort should be made to avoid minor casual *contretemps*.

It can be hardly necessary to add that none of these suggestions are meant, or ought in any way to be taken, as criticisms on the conduct of the Mount Everest expeditions here recorded. Their leaders were hampered and handicapped throughout by a succession of grave pieces of ill luck. They had not to work out according to programme, but to do the best they could in the face of singularly untoward accidents and conditions. And yet they almost—possibly quite?—succeeded in their object. They have proved that the highest mountain in the world can be climbed. Some year, when political barriers

are raised and the monsoon blows less incessantly, there will be a flag on the top of Mount Everest.

The volume is well illustrated, but the diagram on p. 62 is a poor substitute for the missing map.

D. W. F.

Japan.— Rev. Walter Weston. London: A. & C. Black, Ltd. 1926.

8½ × 6, pp. x. + 240. 32 *Illustrations in Colour and a Sketch-map*. 7s. 6d. net.

A new book by Mr. Walter Weston is sure of a welcome from Fellows of the Society, who know that he can both speak and write engagingly on Japan, of which he has had over thirty years' experience; and they know, too, that they can rely on Mr. Weston's words, whether written or spoken, being accompanied by a series of beautiful illustrations. In this latest book they will not be disappointed, and it may be regarded as a companion volume to the author's 'A Wayfarer in Unfamiliar Japan,' reviewed in the *Journal*, 67, p. 75. It is a book of sketches of modern Japan, and shows very clearly the changes that are taking place in the outlook of the people, and the results of their growing competition with the Western world.

Nowhere are these changes more apparent than among the women of modern Japan, and to this subject the author devotes special attention. Japan has always been a "man's country." It is, for example, only recently that women have been allowed the privilege of climbing Mount Fuji or any of the other sacred peaks. At about 5000 feet above sea-level an invisible belt was drawn, above which no woman was allowed to go. These objectionable restrictions were first broken down in 1867, when, for the first time in history, Fuji-san was climbed by a woman, in the person of Lady Parkes, wife of the British Minister. To-day, as Mr. Weston makes clear, the Japanese girl is no longer surrounded by significant reminders of the inborn unworthiness of her sex for many of the privileges of life. If she has not yet attained the status of her sisters in the West, she has at least made a good beginning, and there are many movements of the new age in which she is being allowed to compete with her men kind, and she may become a clerk, a typist, a teacher, a journalist, cinema actress, and even a doctor.

Mr. Weston also shows how the progressive spirit is affecting the manhood of Japan, even in the matter of sport and recreation. "Flower-viewing" is still the great national outdoor recreation, but baseball, golf, and ski-ing are becoming increasingly popular. So, to some extent, is skating, and it is a striking paradox (possible perhaps only in Japan) that the skaters should be able to bathe in the hot springs near by, or warm themselves, while resting, by lighting one of the natural jets of gas that are to be found on the banks of the lakes.

O. R.

Japan in Silhouette.— Trowbridge Hall. New York: The Macmillan Co. 1925. 8½ × 5½, pp. x. + 354. *Sketch-map and Illustrations*. 10s. 6d. net.

It is difficult to account for the publication of this book. The author has little to say that is fresh, and he contrives to bury it in a mass of verbiage that after a short time becomes exceedingly wearisome. In spite of the fact that a very large proportion of the volume is clearly made up of borrowed material, the writer seldom acknowledges his indebtedness to any of the sources of his information. The misstatements on many familiar matters of fact are so numerous as to render quotation difficult, though it may be permissible to specify such as the placing of the date of the Mongol invasion in the fourth century A.D., instead of in the thirteenth; and the naming of Kōbō Daishi as

founder of Buddhism in Japan, its introduction really taking place over 200 years before his time.

There is no index, but on the inside of the cover a clearly drawn map, which is unfortunately disfigured by many mis-spellings of important and familiar place-names. The most valuable chapter in the book is that which gives translations (the source not indicated) of some striking examples of modern Japanese popular literature. W. W.

AFRICA

Rambles in North Africa.— Albert Wilson, M.D. London: Jonathan Cape. [1926.] 9 × 6, pp. 296. *Illustrations.* 12s. 6d. net.

The basis of this rather discursive work is three recent visits to Algeria and Tunis, and its purpose is to enable others to follow the author into that newer field for tourists. Besides Algiers and Tunis, Constantine, Timgad, Biskra, Carthage, and Qairwan are among the places visited, and described in considerable detail. The author appears to have exercised some enterprise in getting away from the main centres. There is much detail on hotels and their staffs, length of journeys, conditions of travel, and so forth, which makes uninteresting, yet doubtless useful, reading. On wider, more general subjects, which one might expect to be treated, there is little direct information. The virtual avoidance of anything that could be called political may of course be deliberate, though the development of the country, progress of colonization, etc., might have been dwelt upon. The narratives of brief trips into the desert and of nights in the remoter towns testify however, indirectly, to the state of the country. The author also shows a desire to understand the life of the peoples encountered. The illustrations are numerous and of interest. The brief notes on geology and ethnology scarcely add to the value of the book.

Sport and Service in Africa.— Lieut.-Col. A. H. W. Haywood, C.M.A., D.S.O. London: Seeley, Service & Co., Ltd. 1926. 9 × 6, pp. 285. *Illustrations and Map.* 21s. net.

Col. Haywood began soldiering in the Niger Delta twenty years ago, when life was full of adventures for young officers of the West African Frontier Force. Many tribes were still fighting against administrative control, and political officers carried their lives in their hands. The military were frequently called upon to help the administration, and the occasional murders of white men led to arduous punitive patrols. The author's account of his early years on the coast is full of interest.

After a period of service in England he was posted to Sierra Leone, where life was less eventful than in Southern Nigeria. It afforded, however, an opportunity for a shooting trip in the French Sudan, followed by an enterprising journey across the Sahara to Algeria. The author has given us in another volume a detailed account of this journey, but he recounts many of its incidents in his latest book. He returned again to Southern Nigeria, and on the outbreak of the Great War he was given command of one of the columns which invaded the Cameroons. His reminiscences of the campaign include one of the many brilliant exploits of that very gallant and much-decorated "Waff," Sergeant-Major Belo Akure.

At the end of 1916, when the Allies were gravely concerned over the shortage of man power, Col. Haywood was sent out to report on the recruiting fields of the West African colonies. Although the intensity of the German submarine campaign prevented full use being made of its resources, British West Africa's

contribution amounted to 70,000 men. In 1920 Col. Haywood was appointed Inspector-General of the West African Frontier Force, which he had joined as a subaltern in 1903. His annual tours of inspection gave him increased facilities for big-game shooting, a sport to which much of his book is devoted. The country is not usually regarded as very attractive to sportsmen, but the author has shown that, given the necessary enthusiasm and energy, most trophies may be obtained in West Africa.

During his travels Col. Haywood collected a good deal of miscellaneous information, but it is to be regretted that he has not taken more trouble to verify the statements he repeats. His historical information is particularly unreliable. The date of the Moorish invasion of Songhai was 1591, and not 1482, and Sir John Glover was not Governor of Lagos during the voyage of the *Dayspring*, but a junior naval officer in charge of the survey work of the expedition. Nor is Carthage a felicitous example of a lost desert city buried in sand. But the book is not intended for the student, and the general reader may be depended upon to forgive when there is so much to amuse and interest him. He must be prepared, however, to endure with his usual patience constant irritation from a most inadequate map.

E. W. B.

The Peoples of Southern Nigeria.— P. Amaury Talbot. 4 vols. Oxford : University Press. 1926. 9 × 6, vols. 1, pp. 365 ; 2 and 3, 976 ; 4, 234. *Maps and Illustrations.* £3 10s. net.

The slowly growing library of literature on Nigeria has been enriched by the publication of this voluminous book. Undertaken in connection with the 1921 Census of population in the southern part of the Protectorate, the task of collecting the information afforded to the reader reveals an immense amount of labour both in research and arrangement. The result is praiseworthy. To one like the reviewer, possessed of many years' experience of the tribes in the Northern Provinces of Nigeria, but of a merely general knowledge of those in the south, the book has conveyed a clearer picture of the mass of tribes along the coast and its nearer hinterland than he has found in any other which he has read.

To hint that there may be some inaccuracies both in the historical and the statistical details should in no way detract from the recognized value of this first effort to attack the subject comprehensively. The task was a big one, and unfortunately for the moment has lacked the scientific help of anthropometry. Mr. Talbot himself remarks in his foreword that the chief work—the classification of tribes and definition of their boundaries—has had to depend almost entirely on the basis of language—a basis which some will think not the most reliable, but the results of some thousands of his personal measurements, which are promised later, will test the correctness of his conclusions.

Out of the mist of earliest times the author has drawn the outlines of the migration of Negro tribes to the whole of Western Africa, and in some seventy pages gives us a general history of Nigeria as a whole from the second millennium B.C. to the present time, tracing foreign influences, the advent of Portuguese and English traders, and the gradual development of the country. The rest of the first volume is devoted in more detail to an account of the peoples as now inhabiting the twelve provincial areas of Southern Nigeria, in which account he disentangles the original threads from about the fourteenth and fifteenth centuries, and shows the various settlements in the different areas. The story of the Yorubas, the Egbas, the peoples of Benin and Calabar is full of interest. Strange weird figures flit across the stage : the Awni of Ife, believed by the

Portuguese to be the legendary Prester John, the mighty Obba of Benin, and the curious kings of the delta tribes. Much, too, is told of the first ventures of Europeans into the coast belt, and of the conditions which they found there.

For the purposes of his ethnological survey the author has divided the population into three main groups: the Sudanese (for want of a better term), the Semi-Bantu, and the Bantu. The most ancient tribe would seem to be the Ijaw of the Sudanese group, who were descendants perhaps of the earliest Negroes who ever penetrated the West African forests. Generally speaking, the Sudanese group (comprising also the Yoruba, the Edo-speaking people, and the Ibo) occupy the west and central portions of the country, and the Semi-Bantu group, of which the Ibibio are most numerous, the east. The Bantu—numerically small—inhabit the south-east corner. When it is remembered that these three groups contain in all some thirty tribes, split up into more than one hundred sub-tribes, and again into two hundred clans or more, one can get some idea of the difficulties encountered in classifying these people on a language basis alone.

There are many maps and tables of distribution showing religious beliefs, influence of witchcraft, types of government, twin-birth tabu, etc.—all useful as data for classification—and the second and third volumes cover a great deal of ground relating to these subjects and to customs of birth, marriage, and death, together with the laws of crime, tabu, inheritance, and slavery.

The chapters on the religion of the tribes, described as being compounded of polytheism, anthropomorphism, animism, and ancestor worship, and the general connection of Nigerian cults with those of ancient Egypt and the Mediterranean area are very interesting, and tend to show how great an effect the Negroes—an intensely religious and spiritually sensitive race—had upon the northern beliefs. Not less interesting is the account of the minor deities, or Ju-jus—our word derived from the French Jou-jou—the symbolic dolls or images which represent the spirits. Mr. Talbot's own words are worth quoting in this connection: "These spirits form the main support of the Negroes' laws and customs—the policeman who detects wrongdoing as well as the judge who punishes it." In the main the spirits would seem to be benevolent or at least neutral, although their functions often are to award punishment or bring retribution upon evil-doers.

These volumes, then, are eminently readable and informative, and are profusely illustrated with excellent photographs. Altogether they mark a distinct advance in our knowledge of West African native races. A. C. G. H.

With the Riff Kabyles.— Bernd Terhorst. London: Arrowsmith. 1926. 9 x 6, pp. 238. *Illustrations.* 12s. 6d. net.

The Fire of Desert Folk. The account of a journey through Morocco.— F. Ossendowski. English text by L. S. Palen. London: G. Allen & Unwin, Ltd. 9 x 6, pp. 312. *Sketch-map and Illustrations.* 16s. net.

The first of these two books dealing with the Maghreb is a very slight collection of articles on the territory formerly under dispute between the Spaniards and Abd el Krim. The author has evidently not had very much experience of the East. In the process of absorbing local atmosphere, of which he has a nice appreciation, he has swallowed some pretty "tall" stories. The book is well produced and very readable. The drawings are a pleasant relief from the conventional photographs which usually accompany this type of volume.

Dr. Ossendowski's book is a more interesting contribution. He made a

journey in Algeria and Morocco of a, by now, somewhat conventional sort. The French authorities did well by him. In showing him all the sights, they showed off their work in North Africa to the best advantage. The author was however too shrewd an observer to be taken in by their rather obvious propaganda, be it never so justified. In some respects the book is a valuable commentary upon the controversy which has arisen on the subject of his Asiatic wanderings. It throws considerable light upon the acumen of the author and his capacity for local observation and deduction. The major problems attending European administration of an Eastern land with all its ancient philosophy are never far from Dr. Ossendowski's thoughts, whatever he may be writing about. For some tastes there may be too much description and telling of picturesque stories, but the vital issues are always remembered and are well postulated. His speculations are made without "romancing." Apart from the political problems, the author has had occasion to wonder a good deal about the popularly accepted racial unity of the Berbers. These doubts, in the face of conventionally accepted dogmas, do credit to a new-comer in North Africa; they are proof, if it be needed, of Dr. Ossendowski's competence as a scientific traveller. If his story is well told, in this book at least it is also good material.

One cannot but regret the spelling of many Arabic names and words. These lapses are the more unfortunate by virtue of the author's reference at the head of his glossary (which itself is far from faultless) to the value of the R.G.S. Committee's work on Proper Names. The photographs are good, but the reproduction does not do them justice.

F. R. R.

AUSTRALASIA AND PACIFIC ISLANDS

Byways of the Tropic Seas. Wanderings among the Solomons and in the Malay Archipelago.— Herman Norden. London: H. F. & G. Witherby. 1926. Pp. 250. 63 *Illustrations and 2 Maps*. 16s. net.

The reputed charm of Bali, "that fragment of land broken off the eastern end of Java," captured Mr. Herman Norden's imagination, and he determined to visit it. But when his plans were made, he tells us, he heard a lecture on the Solomon Islands at the Explorers' Club in New York, and found he wished to see the terrible Solomon islanders almost as much as the beautiful Balinese. So he determined to go to Bali by way of the Solomons, although such a journey involved several thousand miles of extra travel and was something like going "to Glastonbury by way of Goodwin Sands," as Mr. Chesterton has it. When he reached Tulagi, the capital of the British protectorate in the Solomons, he chartered the ketch *Ugi*, in the company of whose owner, Bobby Stirling (trader, planter, and recruiter), he was able to visit Malaita, which island is, in parts at least, still as savage as when Mendafia first sighted it in 1568. Half the book is devoted to this cruise: it is a personal narrative, and though it adds little to our knowledge of the Solomons, Mr. Norden writes with considerable charm and humour of his experiences and of the people he met, both white and black.

The second half of the book makes a good contrast. Malaita was grim, its people savage and grotesque; in Bali Mr. Norden found a lovely land, a beautiful people, with culture, temples, and religious ceremonies that were a strange mixture of primitive and of highly developed faiths. Mr. Norden has the quick eye of the experienced traveller for essentials, and he knows how to keep his reader interested. The result is a very readable book which does reproduce the colour and atmosphere of those tropic islands.

The book is well illustrated and the sketch-maps showing Bali and the Solomons are useful, but the index is deplorable. An index to a book of this kind must be detailed, if it is to have any value for reference purposes. But here we find under the entry "Bali" forty-six references merely to the numbers of pages, while "Malaita" and "Solomon Islands" have thirty-three each, without any subheadings at all, so that any one who is in quest of a reference might search page after page before finding what he wants. O. R.

Western Tasmania. A land of riches and beauty.— Charles Witham.
Hobart: Mount Lyell Tourist Association. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. vii. + 168.
Illustrations and Map.

This handbook gives a detailed description of Western Tasmania and its history, with much information not easily to be found elsewhere. The writer's interests are mainly in the mountains, the beauty of their scenery, and the chances they offer to the lover of nature; consequently he is not altogether disturbed that nine-tenths of the area is uninhabited, that the population is declining, that roads are few. Yet he is writing an account of the whole, and thus there is a full account of the mining industry, of the varied output of metals, including gold, silver, tin, lead, and copper, and the prospects for the future. He also includes a detailed account of the early exploration and the convict station in Macquarie harbour. All these varied aspects are bound together by the obvious enthusiasm of the writer for his subject.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

An Introduction to Earth History.— Hervey Woodburn Shimer, Professor of Palæontology in the Massachusetts Institute of Technology. London: Ginn & Company. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. vi. + 411. 141 *Illustrations*. 12s. 6d. *net.*

We read in the Preface that "The volume is planned to serve as a point of view, a general survey to introduce the student to the more detailed knowledge of the earth than can be gained through chemistry, physics, astronomy, geology, and biology." This rather ambitious programme naturally lays itself open to the objection that applies to all books of a similar nature and size—that it can give only a condensed and rather dogmatic treatment of the matters discussed.

The volume is divided into three parts, dealing in turn with The Cosmical History of the Earth, The Geological History of the Earth, and The History of Life upon the Earth. Each of these in turn deals with matters which can hardly be discussed adequately in one volume, so that while the author has certainly succeeded in making the chapters interesting, they are very sketchy and broad generalizations are made. It is doubtful if the "student" referred to in the Preface would gain very much by a perusal of the work, since the rather vague descriptions would hardly enable him to picture the features described. For example, on p. 76 we read, "When surface melting renders the glacier too light to be able to continue pushing the load beneath it, it rides up over the dropped material, elongating it in the direction of movement of the glacier. These deposits, thus modified into drumlins, correspond to the sand-bars in a stream." Is this a clear description of a drumlin? Again, the dozen lines devoted to Lead and Zinc in the chapter on "Geologic Products of Economic Use" are entirely inadequate.

However, while it is easy to write a distinctive criticism of such a volume as this, there is another point of view. A general summary of the many trends of modern geological thought is useful in focussing attention on the, pre-

sumably, ultimate aim of that science—a complete account of the History of the Earth. In an age of excessive specialization the general reader may be excused for wondering where the specialists are leading. Professor Shimer has, to some extent, coordinated these trends, but we cannot help feeling that he might have done so in a more useful way.

The illustrations in the book are good.

J. A. S.

HUMAN AND HISTORICAL GEOGRAPHY

Geographie des Welthandels : Eine Wirtschaftsgeographische Erdbeschreibung.— Franz Heiderich, Hermann Leiter, and Robert Sieger. Vol. 1, Europe. Vienna: L. W. Seidel & Sohn. 1926. 10 × 7, pp. xx. + 1178. *Eleven Maps.* 42s. net.

Allgemeine und Spezielle Wirtschaftsgeographie.— Dr. Ernst Friedrich. Vol. 1, Allgemeine Wirtschaftsgeographie. Berlin and Leipzig: Walter de Gruyter & Co. 1926. 9 × 6, pp. viii. + 249. GM.12.

We are indebted to Germany for two noteworthy contributions to economic geography this year, in the form of new and completely revised editions of pre-War publications.

One is a new edition of Andrée's 'Geographie des Welthandels,' a formidable tome of 1178 pages, and the other is a theory of Economic Geography by Dr. Ernst Friedrich, Professor of Leipzig University.

Karl Andrée's 'Geographie des Welthandels,' first published during the years 1869–72, was entirely re-written by Professor Heiderich, of the Hochschule für Welthandel, Vienna, and Professor Sieger of Graz University, and the first three volumes were published in 1910–13. The war has made necessary another edition, the first volume of which lies before us, and the editors who have this time enlisted the aid of Professor Hermann Leiter of the Vienna School of Commerce, are to be congratulated on having brought this ponderous volume up to date so rapidly and so efficiently. It requires much energy and courage to publish a work of this sort during a period of economic and political restlessness such as we are passing through, when the information toilsomely collected one day may be out of date the next. We suggest, incidentally, that the publishers may find it expedient to publish annually a set of revisionary notes and comments, which we feel sure would be welcomed by students of economic geography the world over.

The editors have provided a general plan for the various sections of the book, but the authors have been allowed considerable latitude.

The plan of each section is, generally, as follows :

(1) The physical basis of the economic geography including a study of position and boundaries, soil and minerals, climate and vegetation, population and settlement.

(2) A section describing the various regions.

(3) An account of industries, trade, and commerce.

(4) A summing up of the economic position of the country under discussion.

(5) A bibliography.

The longest sections are those on Germany and Russia. Oberst Friedrich Immanuel of Marburg A. Lahn treats his subject, Russia, from the historical and political point of view, and gives but little space to a description of physical conditions. Sixteen pages are devoted to a study of races, religions, nationalities, settlements, and migrations of the people. The study ends with a critical survey of Lenin's ambitions and accomplishments, and a short summary of the political situation. It makes very interesting reading, but one is left wondering how much of it is geography.

Professor Eric Obst of Hanover presents another study which departs somewhat from the general order of the book. He is concerned rather with giving an account of the industrial and commercial situation of Great Britain at the present time than with writing an economic geography of our country. The conclusions he comes to are not encouraging from the British point of view. Indeed, his contribution is something in the nature of an *oraison funèbre*! "Dark and uncertain is the future," he pronounces with, one cannot help feeling, a certain gloomy glee! He bases his "pessimism" on a comparison of 1923 with 1913 trade figures, backed by quotations from Norman Angell; but what he fails to remark is that, as the Committee of Industry and Trade point out in their Survey of Overseas Markets (published 1925), gloomy as the outlook may be, our position in relation to world trade as a whole was better in 1923 than in 1913. In other words, we are all in the same boat, much battered in the War, but Britain had as good a position in 1923, if not a better one, in that boat, than she had before 1914. The Professor pays much attention to Ireland, to the significance to Britain of the Celtic and Roman Catholic fringe, and especially to the revival of the Celtic tongues. "Those who wish to do business with Ireland now," he says, "will hardly be able to make shift without a knowledge of Erse"! Who knows, if the Germans, in the course of their development of the Irish Free State, through the Siemens-Schuckert Shannon and subsequent schemes, equip themselves with a knowledge of Irish, but that they may teach it, with their usual systematic thoroughness, to the Irish themselves? The author prophesies that a spread of the Gaelic language and Home Rule for Scotland will follow very shortly.

The section on France by Professor Vogel of Berlin is perhaps the most complete of these studies. Excellent use has been made of the numerous French monographs and descriptive articles that have appeared in French geographical journals from time to time, and the compressed regional studies of the major "pays" of France are admirably clear and withal picturesque. Throughout, the relation between the physical and economic geography is kept well in view. Full importance is given to the post-War development of France as a metallurgical country, and also to the resulting economic problems that face her, of which not the least serious is that of the ever-increasing foreign element in the ranks of her labour.

It is impossible to review a joint composition of these dimensions in detail; but perhaps enough has been said to give an idea of the scheme of the book. We will content ourselves with adding that the work is done, on the whole, in a very thorough and competent manner, and that the short summary of the present economic position and future outlook of the country with which each section terminates, generally gives evidence of thoughtful and fair-minded study, and in any case is interesting to the English reader as providing an authoritative German point of view.

Volume 2 of Professor Friedrich's 'Allgemeine und Spezielle Wirtschaftsgeographie' deals first with the function of Economic Geography and the study of the factors concerned in economics and their geographical distribution: latitude and climate, land and water, plants and animals; then with Man as an economic being, involving some fifty pages of rather dreary classification which does not appear to get one much further; and, finally, with a study of plant, animal, and mineral economics, industry, commerce, and transport. The work is very thorough in the sense that it is difficult to find anything that could possibly come under the head of economic geography that does not receive at least a mention. This means, of course, that in 228 pages no subject

can be dealt with really thoroughly. Generally speaking, the book consists of a careful arranging and classification of common knowledge rather than a study resulting in fresh ideas. Nevertheless, it does include new and important matter, and the shrewd, critical observations of the author show a keen sense of values in practical matters and augur well for the practical volumes which are to follow.

H. O.

THE MONTHLY RECORD

EUROPE

Early County Maps.

SINCE the article by the Librarian on this subject appeared in the *Journal* for October 1926 a few additional facts have been brought to light, which may here be noted by way of appendix. It has now been possible to examine the MS. maps by William Smith, to which brief reference was made in the article, when the possibilities of authorship of the anonymous series of *circa* 1602-03 were being discussed. Two of these, of Lancashire and Cheshire, are preserved in the MS. Department of the British Museum, while copies of the Cheshire are also to be found in the Bodleian at Oxford. The Lancashire (Harl. MSS. 6159, f. 2) is dated 1598 and signed W. S. R., *i.e.* William Smith Rouge Dragon, and there is no doubt of its original character, the paper being of the period in question. A comparison of this map with the map of Lancashire in the anonymous series shows at once a virtual identity, both as regards the outlines and the place-names. There is agreement both in the choice and in the spelling of the names, where these show divergences from Saxton's original. In both, for example, we find the spelling Rachdale for Rochdale, and on turning to Smith's 'Description of England' (p. 47, as printed in 1879) we read of "Rochdale (comonly called Ratchdale)." The scale too is almost the same (though slightly smaller in the printed map), and in both the north is to the right. The agreement between Smith's MS of Cheshire and the corresponding map in the printed set is not so close, the MS version being in particular a good deal smaller. The British Museum copy (Harl. MS. 1046, f.), though dated 1585, proves to be a later copy, for it is in a MS volume written on the same paper throughout, in which dates as late as 1623 appear, while the style of the watermark seems to point to a later decade still. The Bodleian specimen (Rawl. MS. B 282, f. 18), of which a photostat copy has been obtained through the courteous permission of the Librarian, is very like that in the British Museum, and both show close agreement with the printed map in the courses of the rivers, etc., and the unusual spelling of some of the names (Maxfeld for Macclesfield, Stopford for Stockport, may be instanced) in which we find agreement too with Smith's 'Description of England.' It therefore seems obvious that some connection existed between Smith and the anonymous printed maps of these two counties.

A clue to the engraving of one at least of the maps—Leicestershire—has been supplied by a correspondent, Mr. S. A. H. Burne of Cheadle, Staffs., who points out that William Burton in his 'Description of Leicestershire' (1622) refers to an improved map of the county in 1602 as due to himself and Hondius jointly. The passage in question occurs in the preface "To the Reader," an extract from which has been kindly sent by Mr. E. W. Lynam of the British Museum. It runs: "As for the Topography of this Countie, at the request of a friend of mine I rectified (certain yeres passed, Christopher

Saxtons mappe of this Countie) with an addition of 80 townes, which was graven at Amsterdam by Jodocus Hondius 1602, and since imitated by M. Speed in his great History of Brittain, with an augmentation of the plot of the towne of Leicester, and reduced into a lesser forme and here inserted. . . .” (The reduced map in Burton’s book is merely a reprint, from the same plate and with practically no change, of that engraved by Kip after Saxton for Camden’s *Britannia*.) It does not necessarily follow from the above that the Leicestershire did not form one of the series, for the “friend” spoken of by Burton may have been interested in the whole set of maps. It may even be that he was William Smith. It is interesting to find the definite statement that the 1602 map had been copied by Speed.

A slight inaccuracy in the original article may be here corrected. The English Ortelius of 1606 was spoken of as brought out by Vrints at Antwerp. It was in fact published in London by John Norton, but the plates were certainly supplied by Vrints, and the use of the same paper as for Vrints’ own issue of 1603 seems a reason for supposing that the maps at least were printed at Antwerp, and then sent over to have the English text added on their backs.

The Situation of Clermont-Ferrand.

One of the striking and suggestive studies at which French geographers excel is devoted by Mons. P. Arbos (*Rev. Geogr. Alpine, Grenoble*, 13, 1925, fasc. 3) to a consideration of the situation of Clermont-Ferrand and its effect on the history of the town. The Limagne plain, with which it is closely associated, runs north and south and is shut in both east and west by crystalline massifs, that to the west being reinforced by volcanic outpourings. Its *entourage* may be considered both as a region of contact and one of passage—contact as affording facilities for intercourse with neighbouring districts of widely differing characters, and passage as the crossing-point of routes between distant countries. The plain—level and inclined to be marshy to the north, strewn with volcanic elevations to the south—is everywhere of marked fertility, producing abundant crops of corn and fruit, while the lower slopes of the hills support vineyards, particularly on the west, where they find shelter from the strong winds. The mountains on either side produce timber and pasturage for flocks and herds, and both plains and mountains supply excellent building stone. Human settlements therefore found in this region all the elements of prosperity in the exchange of these various products. The district is fortunate, too, as the meeting ground of lines of more general circulation, for while offering the one decided break in the Central Massif from north to south, its east and west barriers are more easily surmounted here than in other parts, and it is through Clermont-Ferrand that relations have been established between Lyon and Bordeaux, as well as between Northern and Southern France. Here, too, the passage of the rivers has been easier than elsewhere, and from the twelfth century on the Pont du Château over the Allier was the one and only passage of that river for a very long distance. On the other hand, the central situation of Auvergne, far removed from all ports or national frontiers, has been a drawback, and the poor facilities for navigation offered by the Allier have been another. A rich region like that under discussion was anyhow bound to attract human settlement, and suitable sites are plentiful, whether on the hills to the south, the banks of the Allier, or the western border of the Limagne, where the volcanic outpourings from the Dômes have offered special advantages through the water-supply issuing along the zone of contact with the underlying impervious strata. Clermont-Ferrand did not however take its present assured place as capital

of Auvergne without the competition of rivals, and the last section of the paper is devoted to a discussion of the reasons for its triumph over the ancient capital of Gergovia. The latter's importance in the time of Cæsar's wars was due to its unequalled facilities for defence; and when Cæsar finally defeated Vercingetorix and imposed the *Pax Romana*, such considerations were of less importance, and were even directly unfavourable to commercial development. Nemossos was in every way more suited to men of peace, and its choice by the Romans to replace Gergovia gave it, besides, the further advantage of a political and administrative centre.

ASIA

The Hai-ninh District, Tongking.

A detailed study of Hai-ninh, a portion of Tongking between the Red River and the Chinese frontier, is contributed by M. E. Chassigneux to *La Géographie*, August 1926. Without easy communication with the Hanoi delta, from some points of view it may be regarded as a south-west extension of Kwangtung, to which the coastal plain gives access. A feature of its morphology is the parallel direction of islands, coast-line, mountain ranges, and valleys, all trending from south-west to north-east. Four geological zones are distinguished in the mountain region. Behind the alluvial plains are low hills of red sandstone, succeeded in turn by old schists and more resistant conglomerates. In the interior is the bold granite massif, with a sparse vegetation covering, and cut by deep ravines, which gives place on the west to the even more eroded triassic formations. The distinct erosion forms of each of these areas are described in detail. Hydrographically, the rivers form a consequent system, cutting across the formations to the coast. They are in a state of immaturity, with steep profiles and many falls. So deeply have they cut into the alluvial plains that the heavy seasonal rainfall is carried off without flooding.

The coastal plain has some unusual characteristics. The river courses are marked by small rapids almost down to their mouths. Behind the islands they have built up deltas, which, with mangrove swamps are gaining rapidly on the sea. These and other facts point to a recent slight rise in the level of the land, which has rejuvenated the drainage system. This is particularly evident in the delta of the Song Ca-long. Its mouth is more exposed to tides and currents, under the action of which a long sandy spit of about 14 km. has formed, resting upon a rocky island to the south, and separated from the rest of the delta by an arm of the sea, where deposition is taking place. In the upper part of the delta, traversed by two branches in deeply cut beds, erosion and not deposition is taking place. On the original surface of the delta are abandoned branches of the river, with some small recently developed obsequent streams. The paper also deals in detail with the character and distribution of the population. One feature is the advance into this frontier transitional region of Chinese immigrants at the expense of the Anamese, an advance which the author would like to see checked by the Government.

AFRICA

The 1/Two Million Map of Africa.

The Acting Surveyor-General of Egypt calls attention to an error in Sir Charles Close's article in the *Journal* for September last, page 255. Speaking of the 1/2,000,000 map of Africa he said that the Geographical Section, General Staff had completed no fewer than eighteen sheets, the French had published three provisional sheets, and the Survey of Egypt one.

The Acting Surveyor-General asks us to state that the Survey of Egypt has not published any sheet of this series. Reference to the Sudan sheet in question shows that it was compiled and drawn for the War Office by the Sudan Survey Department, Khartoum, 1920-21, was printed by the Survey of Egypt in 1922, and was published by the Geographical Section, General Staff. Although therefore the sheet is included in the block which was assigned to the Survey of Egypt it was not published by them, though their name appears as printing it.

The Kalahari Reconnaissance of 1925.

In 1925 a reconnaissance party, organized by the South African Dept. of Irrigation, visited the area between the Zambezi and Lake Ngami to collect facts upon which the further discussion of the "Kalahari redemption scheme" might be based. The Report has now been issued by the Department (Report of the Kalahari Reconnaissance of 1925. Pretoria, 1926). With this scheme the name of Dr. E. H. L. Schwarz has been identified, and at his request he was allowed to accompany the party, the leader of which was Dr. A. L. du Toit. Dr. Schwarz has already described in the *Journal* (67, 528-35) a journey he subsequently made to Lake Ngami and the Botletle River. The work was to be particularly devoted to obtaining details on levels, river discharges, meteorological and geological features, and the area was to be surveyed. Two aeroplanes accompanied the party, and air photographs were made of the Zambesi from the Victoria Falls to Katima Molilo, and of portions of the Linyanti (Kwando), Makwegana, and other rivers. A map on the scale of 1/500,000 accompanies the report. The method generally adopted was to combine compass and stadia reading with levelling operations, the traverses thus obtained being controlled by eight astronomically determined positions. Time signals were received from Lorenzo Marques and Slangkop. The total distance over which levelling was carried out was 730 miles. Appendices to the Report also give notes on the discharge of the Zambesi, analyses of soil from the Kalahari, and meteorological observations. The body of the Report, however, deals mainly with the hydrography of the area from the point of view of irrigation schemes both on the scale proposed by Dr. Schwarz and of lesser magnitude. As is acknowledged in the report, some of the material utilized here has been obtained from other sources; the party did not examine the Okavango or the Botletle rivers, and much research remains to be done in this area. Without entering into details, the final conclusions of the reconnaissance may be summarized here. The existence of a "Greater Ngami," which has since disappeared through desiccation, is denied. No lacustrine deposits were observed in the neighbourhood, and it is suggested that the Makarikari depression has been deprived of its water-supply by faulting and sinking probably connected with the East African Rift Valley. It might be possible to canalize the lower Okavango and lead the water into the Makarikari depression, though it is likely that this would simply remove the area of swamp from the one place to the other. The only method of obtaining water for irrigation purposes on a large scale would be by damming the Zambesi at Katombora and diverting the water into the Mababe depression. After provision for maintaining the Victoria Falls, one-tenth of the Zambesi's discharge, at the expense of two-fifths of the flow, could be diverted in this direction.

AMERICA

Forest Resources of Canada.

The present condition and prospects of the forest industries of Canada are fully described by Mr. R. D. Craig of the Dominion Forest Service, in *Economic Geography*, July 1926. Second in importance only to agriculture, their products comprise 23 per cent. of Canada's exports, the value of the paper and pulp produced annually being 182, of lumber 126, and other items 57 million dollars respectively. It is stated that 13 per cent. of the total land area is under exploitable timber, but that one-half of this is still inaccessible. On a physical and climatic basis, Canada is divided into three forest regions: the Cordilleran, the Great Plains, and the Eastern. Similar factors produce the various belts within each of these. Thus the Cordilleran timber ranges from the Douglas fir—red cedar type of the south coastal belt to the Lodgepole pines growing up to 7000 feet on the Rockies. The main area in the Great Plains, the Northern Forest belt 300 to 400 miles wide, lies between the prairie belt, thought to have been mainly cleared by fire, and the Sub-Arctic region. Here the white spruce predominates. This belt extends into Eastern Canada north of the St. Lawrence-Hudson Bay divide, where, through bad drainage, the black spruce tends to predominate. South of this, beyond the transition belt, from Lake Superior to the mouth of the Saguenay, lies the mixed Hardwood-Softwood type, the white pine area, which has been most exploited for lumber.

Similar influences have controlled the methods of lumbering. In the hard winters of the east and the Great Plains the timber is cut and logged by sleighs to the rivers for the spring thaw; in British Columbia the problem is an all-the-year-round engineering one, and the logs are hauled by cable and railways to the water or to the mills. The annual cut is approximately 2500 million cubic feet; of this 822 million are used by the lumber industry, and 362 million for pulp and paper. Of the 3000 saw mills, most are in Quebec, but the best are in British Columbia, where, unlike Eastern Canada, the industry is growing. The total annual output of lumber (1919-23) was \$130 million, of which Eastern Provinces produced \$80 million and British Columbia \$46 million. In the paper and pulp industry however Quebec leads the way, producing \$76 million, as against 61 by Ontario and 15 by British Columbia. In the export trade the outstanding fact is the predominance of the United States, the receiver of 82 per cent. of Canada's forest exports. It is said that two-thirds of the newsprint used there originates in Canada. As to the future, Mr. Craig considers that fires have caused the greatest damage to the original timber stand. Up to the present 60 per cent. of this has been lost in clearing and by fires, and only 13 per cent. by use. Thus if forest fires could be prevented and logging improved to favour reforestation, he thinks present output could be maintained.

Seismological Work in the United States.

The *Bulletin* of the Seismological Society of America for September 1926 contains two or three items of interest. Mr. R. H. Tucker discusses carefully the possibilities of ascertaining changes of position of portions of the crust due to earthquakes by triangulation measurements. The results of determinations of position at different epochs for various stations in California on either side of the San Andreas fault are tabulated, with the result that the averages of the residuals seem to be larger than should be due to the probable errors in the triangulations. The four epochs dealt with are 1855, 1885, 1907, and 1922, and it is found that the average residuals are much alike at all,

close to 3 feet, while those at mean distances of 3 miles from the fault are not sensibly larger than those at 18 miles. The conclusion is reached that when the systematic errors at each epoch are combined with the accidental errors of triangulation, the residuals may not greatly exceed the sum. Between 1885 and 1907, however, the period which included the great earthquake of 1906, the figure for the displacement is convincing even at average distances of 11 miles from the fault. In another paper Mr. N. H. Heck discusses and maps the distribution of earthquake epicentres in the North Pacific, showing their association in general with deep submarine troughs. Near the supposed Aleutian trough however the epicentres are widely scattered, and it is held to be very desirable that an accurate survey of the bottom of this part of the ocean should be made. In a paper on the Jesuit seismographic stations in the United States and Canada, the Rev. J. B. Macelwane, S.J., points out that the interest in seismology displayed by Jesuit institutions in recent years has been due to the initiative of one man, the Rev. F. L. Odenbach, S.J., who in 1909 addressed a letter to all the Jesuit Colleges and Universities in the States and Canada, with the result that instruments were installed at eighteen different stations, and regular observations kept up for some time. But interest subsequently flagged, until latterly only two stations in the United States were still publishing earthquake data. In 1925, however, as a result of a conference at Chicago, a new Jesuit Seismological Association was formed, and it is hoped that good results will follow if sufficient funds are forthcoming.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Tropical Glaciation of the Past.

In a new paper contributed to the *Quarterly Journal of the Royal Meteorological Society* (July 1926), Mr. C. E. P. Brooks once more recurs to his thesis that changes in geographical factors suffice to account for past changes in climate, devoting attention this time to the outstanding difficulty suggested by tropical glaciation at sea-level. The title of the paper is "The Meteorological Conditions during the Glaciation of the Present Tropics, being some Remarks on the Climatological Basis of Wegener's Theory of Continental Drift"; but there is really little contact with Wegener's hypothesis except in the conclusion reached that in Permo-Carboniferous times there is little doubt that glaciers reached sea-level in the lands where Wegener draws the equator, and no doubt at all that glaciers reached sea-level in the lands cut by the present equator.

Mr. Brooks follows the palæogeography of Arldt, who has reconstructed the arrangement of land and water in the Permo-Carboniferous epoch. This reconstruction is based on the present position of the continents, discarding altogether Wegener's doubtful conjectures, and is exhibited in a map of the World on Mercator's projection. The great equatorial continent of Gondwanaland, which is the central feature of the whole discussion, embraced much of present-day Africa, extending over North-West India, Australia, and eastern South America, in all which regions there is evidence of heavy glaciation. The continent of Nearctis corresponds to much of North America, that of North Atlantis to Northern Europe and the Icelandic region, and Angaraland to Siberia, while the central sea of Tethys separated Gondwanaland from North Atlantis and Angaraland, the Volga Sea separating the two last-named land masses. Warm equatorial water poured into the northern Volga Sea, around the eastern side of Gondwanaland, giving a relatively warm climate to that region. The southern side of Gondwanaland rose abruptly from the cold

Southern Ocean, affording conditions highly favourable to the establishment of a persistent moist S.E. Monsoon. Mr. Brooks finds that, postulating certain probable initial conditions, the snow-line on Gondwanaland would be reached at 6000 feet, and as much of this equatorial continent exceeded this height extensive snow-fields would develop. The resulting glaciers no doubt could descend to sea-level if they possessed a broad enough front to carry their own cold down with them, but, as fully recognized by Mr. Brooks, the possibility of this occurring in the Tropics must depend on an exceedingly rare combination of favourable factors such as appears to have been realized only once in the history of the Earth. Among these conditions persistent cloudiness shutting out the equatorial sun would be an essential accompaniment of the monsoon wind blowing on to Gondwanaland, in addition to the heavy snowfall. One might, indeed, go a step further than Mr. Brooks, and say that for such a low snow-line as 6000 feet to occur on an equatorial continent the cloudy monsoon in question would have to prevail with something like absolute persistence, and not subject to the occasional interruptions to which even the most regular winds of the present time are liable. It is considered that all the Gondwanaland glaciers reached the southern coast except at one point on the north coast represented by the glaciation of which there is evidence in North-West India. As the Permo-Carboniferous was a time of active mountain building, it is thought probable that volcanic dust was an accessory source of cold in accordance with the demonstration of its efficacy by Prof. W. J. Humphreys of the United States.

GENERAL

The late P. P. Semenov-Tian-Shanski.

The hundredth anniversary of the birth of this Russian geographer, Gold Medallist of the Society in 1897, occurs on 14 January 1927, and as his death in 1914 was accidentally (in part no doubt owing to the outbreak of the war which speedily followed) allowed to pass without adequate notice in the *Journal*, it is fitting that something should now be said of his important services to geography during the greater part of his long life. He had long been regarded as the Doyen of Russian geographers, and besides doing valuable work in the field by his explorations in Central Asia, he was for many years the moving spirit in the Russian Geographical Society, and by the help and encouragement which he gave to younger explorers and geographers did more than any man of his time to further the cause of geography in Russia. He had been destined for a military career, but abandoned the idea in 1845 and entered the University, passing through the course in Science with distinction. In 1849 he joined the Russian Geographical Society, becoming its Librarian, and in 1850 Secretary of the Section for Physical Geography. He took a foremost part in the great undertaking of the translation into Russian of Ritter's monumental 'Geography of Asia,' and—a more difficult task—its extension by the incorporation of the large amount of new material that had accumulated since the work was first written. It was in connection with this work that he undertook his own extensive explorations of some of the least-known parts of Central Asia in the regions of the Altai and Tian Shan. Begun in 1856, they yielded a rich harvest of scientific observations. Continuing his work as editor of the Russian edition of Ritter, he became President of the Physical Geography Section of his Society in 1860, and in 1873 succeeded Von Lütke as Vice-President of the Society as a whole. Meanwhile he had undertaken the formidable task of editing a complete Gazetteer of the Russian Empire—a task brought to a successful

close in 1885. Another great undertaking, begun in 1899 when he was already seventy-two years old, was the preparation of a detailed geographical description of the Russian Empire in twenty-two volumes, of which nine had already appeared before his death.

Gilchrist Studentship.

The Gilchrist Trustees again offer, for 1927-1928, a Geography Studentship of £80, tenable at any recognized school of geography, with a view to the furtherance of improved teaching of geography in schools. Applicants, who should be teachers with at least two years' experience, should send in their names to Prof. L. W. Lyde, University College, Gower Street, W.C.1, from whom further particulars may be obtained, before 31 January 1927. They must give references and a full account of their previous work, and their applications should be accompanied by three testimonials.

Return of the Shaksgam Expedition.

During the past summer an important exploration of the Shaksgam region has been made by an expedition organized by Major Kenneth Mason, M.C., R.E., Survey of India, with the support of the Government of India and contributions of equipment, including the Wild photo-theodolite, from this Society. With Major Mason were Major H. D. Minchinton, M.C., 1st Gurkhas, Major R. C. Clifford, D.S.O., I.M.S., Captain F. O. Cave, M.C., Rifle Brigade, and Khan Sahib Afraz Gul Khan, Survey of India. The expedition has now returned to India after surveying about 2000 square miles of the Upper Shaksgam and the country north and west, and Major Mason will read a paper on the preliminary results of the expedition early in the New Year.

OBITUARY

Prof. Olinto Marinelli

GEOGRAPHY in Italy has suffered a severe loss by the premature death, on 14 June 1926, of Prof. Olinto Marinelli, one of the most zealous and active exponents of the subject in that country within recent years. Son of Giovanni Marinelli, himself a geographer of note, the deceased was born at Udine in 1874, and in 1892 accompanied his family to Florence, when his father was called to the Chair of Geography at the University there; he himself took the University course in Natural Science at that University, gaining his Doctor's degree in 1895. Even before this he had been an active collaborator in the *Rivista Geografica Italiana*, then lately founded at Rome, of which his father had soon assumed the direction; and he continued until his death one of the most regular contributors to the pages of this leading Italian geographical review, the chief direction of which he eventually assumed, after his father's death, in 1902, while he succeeded his father also in the Chair of Geography at Florence. His geographical work was not however confined to its literary and educational sides, for he travelled widely for the purpose of research, bringing home valuable results from the expedition to Eritrea carried out in association with Dainelli, and also taking an important part in De Filippi's great expedition to the Karakoram. He took broad views of the scope and aims of geography, laying stress on its twofold relation to the sciences of nature and man, and his geographical writings covered all branches of the subject. His recent work for the great Italian Atlas of the "Touring Club Italiano" deserves special mention. He had been an Hon. Corresponding Member of the R.G.S. since 1906.

Dr. Gottfried Merzbacher

The Society lost another of its Hon. Corresponding Members last year in the person of Dr. Gottfried Merzbacher, originally placed on the list in 1909 and reinstated a year ago, with others of his compatriots, after temporary removal as a result of the War. Dr. Merzbacher first came to the notice of geographers through his mountaineering ascents in the Caucasus, begun in 1891 in the central part of the range, of which accounts were sent to the Society through Mr. Freshfield. He returned to the same field in 1892, accomplishing a number of ascents in the eastern part of the range—eleven peaks over 12,000 feet were ascended—and obtaining photographs and other observations of value for the detailed mapping of the range. The results of his own explorations, combined with information collected from all available sources, were eventually given to the public in 1901 in two bulky and valuable volumes bearing the title, 'Aus den Hochregionen des Kaukasus' (reviewed in the *Journal*, vol. 18, p. 611).

The traveller's later work was devoted to a still more remote and little-known region—The Tian Shan and neighbouring parts of Central Asia—to the detailed exploration of which he devoted himself with great energy. The Central Tian Shan was the goal of a first expedition in 1902 and 1903, the results of which appeared in German as a supplementary number of *Petermanns Mitteilungen* (149, 1904), and also in English in a volume published under the auspices of this Society. Having completed their publication he gladly seized the opportunity of returning to the same range in 1907 in company with Prince Arnulf of Bavaria, who had organized an expedition to that part of the world for the purpose of sport. On the Prince's return to Europe (where he shortly succumbed to inflammation of the lungs) Dr. Merzbacher remained in the field for a second year's work, devoting full attention to the morphology and geology of the range, and bringing back observations of no less value than those of his earlier expedition. A preliminary account of the expedition was contributed by the traveller to our *Journal* in letters written by him while still in the field, and some of the more technical observations were published by the Bavarian Academy of Sciences at Munich. As a result of his journeys Dr. Merzbacher took a recognized place as an authority on Central Asia, and from time to time contributed papers on its geography to various German geographical serials.

CORRESPONDENCE

Positions in Aïr

AT the time when Appendix I. of my book 'People of the Veil' went to press, I had not had the advantage of access to the most important 'Rapport de la Mission du Transafricain,' edited by Captain Nieger and published in Paris by the *Société d'Éditions Géographiques*, etc. I should otherwise certainly have incorporated in my table of astronomical positions in Aïr and the country to the south, the positions which that expedition secured, and which are given on the various 1/400,000 sheets showing the suggested track of the proposed French Trans-African railway. The observations which I made at Teshkar (Taskr) and Guliski (Goullouski) duplicated determinations made by the French expedition with results which differ somewhat. The positions are :

			<i>Mission Nieger.</i>	<i>Rodd.</i>
Teshkar :	Latitude N.	.. ..	15° 07' 30"	15° 07' 40"
	Longitude E. of Gr.	.. ..	10° 43' 23"	10° 35' 10"
Guliski :	Latitude N.	.. ..	15° 01' 50"	15° 00' 50"
	Longitude E. of Gr.	.. ..	9° 12' 24"	9° 06' 20"

Part of the discrepancy is due to the different positions of observation. At Guliski, for instance, there are various points which might be taken as the site of the village; when I was there the watering-pools were extensive and numerous, and the huts of these villages are always liable to be moved from site to site within a certain area. Nevertheless I of course regard my own observations as rather tentative approximations, compared with the results which the scientific *personnel* and material made available to the Mission Nieger in its great work.

My speculations regarding the country south of the river of Agades have in part been borne out and in part supplemented by Sheet 17 of the Nieger expedition map. A few points require correction in the text of my book, notably that (pp. 66 and 74) Tateus is a rainpool and not a well.

FRANCIS RODD.

December 1926.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

First Evening Meeting, 8 November 1926.—The President in the Chair.

PAPER: The Work of the Central Asiatic Expedition in Mongolia. (The second "Asia Lecture.") Dr. Roy Chapman Andrews.

First Afternoon Meeting, 15 November 1926.—The President in the Chair.

PAPER: The East Anglian Coast. Mr. J. A. Steers.

Second Evening Meeting, 22 November 1926.—The President in the Chair.

ELECTIONS.—Hugo Addinsell; Thomas Ashton; Charles Henry Archbould Bagshaw, M.A.; Capt. Edward Beirne, A.E.C.; Capt. Jacob Percy Best; John A. Bolton; G. T. Braddock; William Richard Brunskill Briscoe, C.B.E., M.A.; Charles H. Brown; James Chapman Brown; Lieut.-Commr. William Harmer Brown, R.N.R.; Geoffrey Henry Bushby; William G. Caird; Percival Campbell; Mrs. Ada Mary Nolan Carr; Percival Richard Fenton Carter, F.R.C.I.; Mrs. Olive Murray Chapman; Major Arthur Reginald Chater, D.S.O., M.C., R.M.; Anthony Fielding Clarke, M.A.; Geoffrey Charles Cleverly; Miss G. S. Cliff; Frank Derek Corfield, B.A.; Miss Alice Gladys Cross, B.A.; Rev. Sidney John Daltry, M.A.; Eric Henry de Bunsen; Ronald de Pass; H. Peter de Silva, B.A.; Capt. John Samuel Dodd, B.A.; J. Scott Duckers; D. E. Ellepola, B.Sc.; William John Ervine; Elmer J. Faucett; Prof. Pierpaolo Luzzatto Fegiz, LL.D.; Miss Christine Catherine Fellows; Frank Foley; Prof. Bernard Freeman; Miss D. Jean Garlick; Major M. L. A. Gompertz, I.A.; D. D. M. Gooneratne; Herbert Thomson Grant; James Stevenson Hall Grant; Frank Gray; Robert Scott Greenshields; William George Howard Gritten, M.A.; Charles Herbert Hamilton, O.B.E.; James Hay, M.C., B.Sc., A.M.I.C.E.; D. Henry Heap; Miss Ann C. Herbertson, L.L.A.; R. Stuart Horner; Edmund Charles Thomas Horniblow, B.Sc.; The Marquis Hosokawa; Capt. Bruce Humfrey, LL.B., I.A.; Frank W.

Hutchinson; Carl Jacobsen; Donald Albert Jennings, B.A.; Mrs. H. Lander Johnston, M.R.I.; George Eric Jones, B.Sc.; Saravanamuttu Karthigesu, B.Sc.; Frederic Keller; Prof. Watson Kirkconnell, M.A.; Arthur Kohnke; Rev. Frank D. Learner; George Martin Lees, M.C., D.F.C.; William Henry Legge; Harry Vaughan Letts; Capt. Thomas Reginald Montague Livesey, B.A., M.B.O.U.; George Lovibond; Yuko Maki; Prof. Percy Alvin Martin, M.A., PH.D.; Saburo Matsukata; H. A. Matthews, B.A.; Charles Augustus Midgley; Miss Alice Eva Marion Milnes; Miss Jean Brown Mitchell; F. E. Monk; Lieut.-Col. Philip Augustus Moore; Ralph Sisk Morgan; Miss Kate Morrison, M.B.E.; Capt. Sir Pyers G. J. Mostyn, Bart., M.C.; Mrs. Herbert Musgrave; Edward Noel Mylius; James William Naukivell; Laurence Arthur North; Edward Pape; James Parker; Rev. Harold Shepherd Perkins; William Alfred Perkins, B.A.; Miss Claudia Phelps; Leonard S. Pickard; Rev. Harold Pickles, B.A.; John Christopher Flews; A. J. Pope; Frank W. Preston, B.Sc., PH.D.; Flight-Lieut. Noel Gratton Pring, R.A.F.; Peter James Pringle; George William Purves-Smith; Mrs. Lavinia Reynolds; Rev. Albert Ernest Richardson, D.D.; Rev. A. T. Richardson, M.A.; Lieut.-Col. J. Cunynghame Robertson; Lieut.-Commr. Leonard Mansfield Robinson, R.N. (Retd.); Dr. William Arasaratnam Rogers; Walter Rose; Capt. Christopher Gerald Rows, R.E.; F. C. Sands, M.B.E.; Paul de Schubert; Miss Eva Russel Scott; Eric Lord Hyde Sexton, A.B.; Dr. George Cheever Shattuck; Eden Shedden, B.A.; Lieut. Geoffrey Sherriff, R.A.; Hugh Vurnum Simmons; Lieut. Oswald Reresby Sitwell; Richard John Slader; Charles Andrew Smith; Walter Buchanan Smith, M.C.; Stephen Stagg; Capt. Graham H. Stewart; Mrs. Man Stuart; Walter Summers; Rev. Thomas Whitehead Taylor, M.A.; Lieut. E. F. Tenison; Cecil George Thorne; Fleming Voltaire Van der Byl; Reginald Arthur Wadey, B.Sc.; Prof. Hachiro Watanabe; Edward Weigall; Ernest Austin Weir; Lieut. Peter Francis White, R.E.; Norman Whitehead; The Rev. Alan Williams, M.A.; Cecil Pirie Williams; Thomas B. Williams; William Washington Williams, B.A.; Samuel Wright.

PAPER: South-west Tanganyika Territory. Mr. C. Gillman.

Third Evening Meeting, 6 December 1926.—The President in the Chair.

ELECTIONS.—Robert Alfred Abigail, B.A.; Charles Arthur Andrews; Major F. W. Cavendish Bentinck; William E. Brenner; Miss Bertha Cecilia Chaplin; H.I.H. The Prince Chichibu of Japan, G.C.V.O.; Mrs. Frank Dawes; C. H. Fenwick; Capt. Henry Hughes; Raja Ravisher Singh of Kalsia; Rev. Jesse R. Kellems, PH.D.; Oliver Dennis Kendall; John Frederick Knight, F.R.S.A., F.R.H.S., F.Z.S.; Lieut.-Col. Joseph Henry Levey, D.S.O., O.B.E.; Samuel Lord; Arthur Austin Miller; Jai Narain; John Joseph O'Leary; Rev. Abraham Ray; Harold Carmichael Robson; Hussein Kamil Selim, B.A.; Hubert Hoare Francis Sirr, B.A.; Lieut.-Col. G. A. J. Soltau-Symons; Mrs. Mowbray M. Spencer; Lieut.-Col. George Ashton Strutt; Joseph Swire; Francis Gordon Taylor; Capt. H. K. Turner, M.C.; John Wilfred Turner; Samitaro Uramatsu; Milton Waldman; Bertram Weaver.

PAPER: The People of the Tsangpo Gorge. Earl Cawdor.

Second Afternoon Meeting, 13 December 1926.—The President in the Chair.

PAPER: Ancient Survey Instruments. Col. Sir Henry Lyons.

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SOUTH-WEST TANGANYIKA TERRITORY

C. Gillman

Read at the Meeting of the Society, 22 November 1926.

MODERN geography demands Regional Surveys conducted by experts working in cooperation. But the same surveys are required if we wish to administer and develop our territories beyond the seas along the only sound lines—those dictated by geography. Such surveys ought, therefore, to be established and furthered at a rate which will guarantee full knowledge within a reasonably short time. That they will cost a good deal there can be no doubt, but that this money will be well invested, apart from the infinitely more important credit-balance of increased human well-being, there can also be no doubt.

In the meantime this regional work, at least in East Africa, is going on in a haphazard fashion. Administrators, agricultural officers, doctors, and engineers have many opportunities, during their official wanderings, for contributing to an ever-wider acquaintance with the countries concerned; but however thoroughly we have grasped the necessity for geographical studies, however ardently we endeavour to add to our knowledge, our often narrowly defined official duties do not leave us sufficient time for thorough investigations in the field, for the essential preparatory work prior to an expedition, and least of all for anything like a sufficiently complete elaboration of the results after our return. Besides, we are, most of us, amateurs; and even those who may possess sound knowledge in one restricted field are bound to be amateurs in most others.

You will not expect me to allow the truth of Dr. Dixey's recent statement that the engineer, when he *does* grasp the geography of the country, does so probably unconsciously (*Geogr. Journ.*, 58, p. 137). The engineer must fully understand that penalties are attached to any disregard of geography, and it was as an engineer in search of railway lines that I have recently spent seven months zig-zagging through the south-western districts of Tanganyika Territory, of which I wish to give you a geographical description to-night. It is an area which has been much to the front of late, ever since the labours of the East Africa

Commission have drawn attention to its dormant possibilities, and the difficulties of which, physical as well as economic, must be understood if the right thing is to be done about its development.

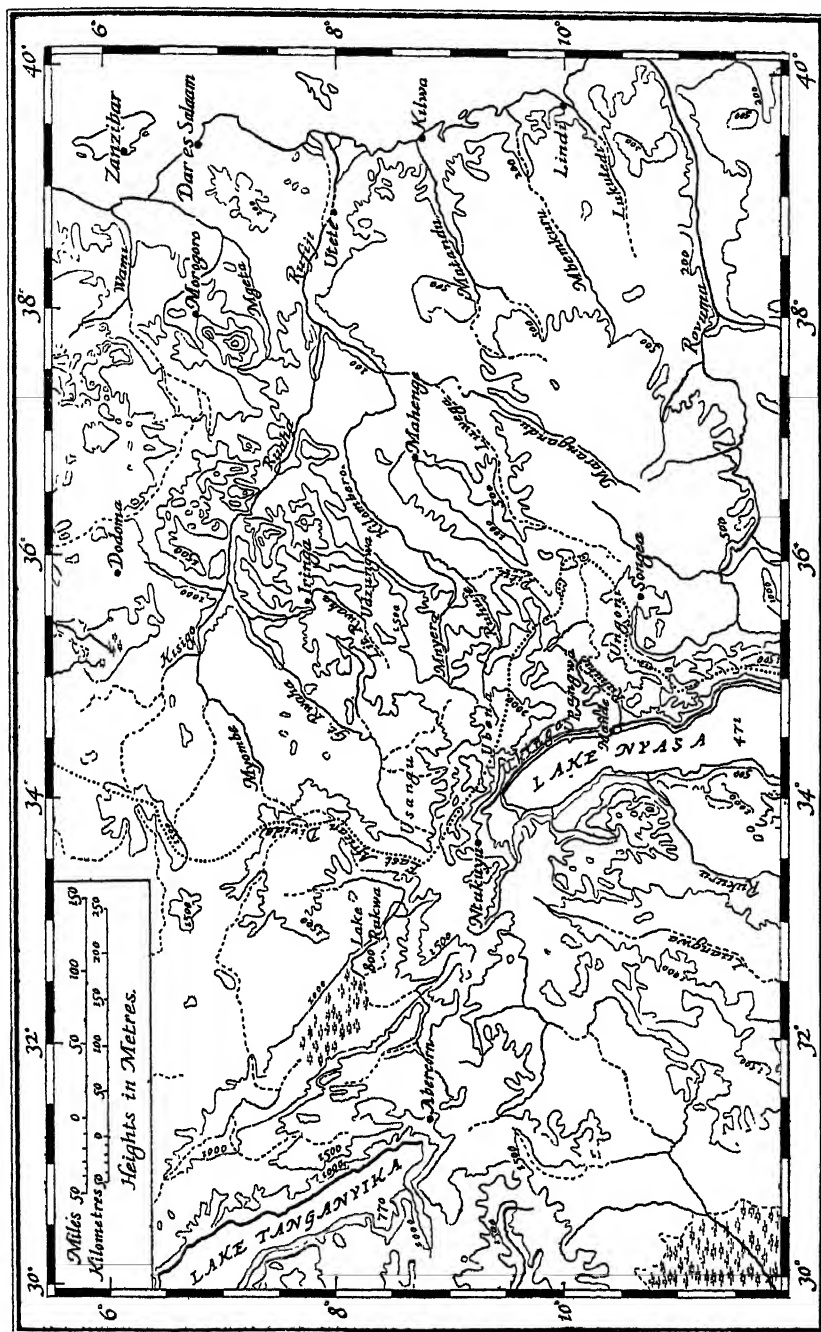
The region which, for lack of a more suitable term, I call South-West Tanganyika Territory, may be defined as follows: Geographically it comprises the drainage areas of the Kilombero and upper Rovuma, the mountainous east coast of Lake Nyasa, the volcanic region to the north of that lake, and the westwards adjoining highlands of the Nyasa-Tanganyika divide, that is the country between roughly S. lat. 8° and 11° and E. long. 33° and 37° . It is bounded in the west by the lake and the western scarp of the Nyasa trough, and is separated from the coast of the Indian Ocean by the wide strip of practically uninhabited, badly watered and bush-covered ground which forms the hinterland of Kilwa and Lindi. Politically the region is taken up by the administrative districts of Mahenge, Songea, Rungwe, and the southern part of Iringa (Ubena and Udzungwa). Iringa proper, *i.e.* Uhehe, is thus not covered by this definition; for geographically it belongs to the basin of the upper Ruaha and economically to the central belt of Tanganyika Territory, to whose main artery of trade, the Central Railway, it has access over comparatively easy ground.

Of the early explorers who have given us first impressions of parts of this area are Livingstone, Elton, Cotterill, Giraud, and, above all, Joseph Thomson, whose keen geological eye made him recognize very early the Rift character of the Nyasa trough. Kerr-Crosse's wanderings of 1890 through Kondeland and the western plateau contain much of interest.

The first detailed descriptions, approaching in many instances to regional studies, are contained in the two great and well-known works by Bornhardt, a geologist, and Fuelleborn, a medical man with zoological and ethnographical training. The former's careful surveys in the southern and western part of our area, his well-grasped geological outlines, and above all his vivid and lucid pictures of the country which I reckon among the best I have read in scientific geographical literature, still form a most accurate foundation to our knowledge. Fuelleborn, on the other hand, contributes much useful matter about the peoples which is of particular importance, as his observations were made at a time when contact with European civilization had only just been established.

A good and concise summing up, a desk-study based on everything that was known of the western part of our area in 1913, is Miss Frey's monograph on what was then German Nyasa Land.

On the eastern portion geographical literature is very scant. We have Dr. Scholz' useful east-west geological traverse between Mahenge and Ntukuyu; and long before him Dantz had supplemented Bornhardt's observations in some parts, without, however, reaching his predecessor's

*Sketch-map of South-West Tanganyika Territory*

high standard. The report and sketch-map by a German railway reconnaissance party who, in 1912, were the first to penetrate into the wilds of the Pitu valley, are most disappointing documents from the technical point of view, and contribute next to nothing to our geographical knowledge.

Of maps, the 1 in 1 Million and 1 in 300,000 sheets, compiled almost exclusively from route surveys, have all the disadvantages of such maps : mainly this, that the amount of detail and the accuracy of representation varies very considerably and often within a few miles. But of two restricted areas we possess better material : Kohlschuetter's 1 in 100,000 map of the central Livingstone Mountains, and a very beautiful and, as regards topographical detail, very accurate map to the same scale, of the Nyasa trough between the north end of the lake and Rungwe volcano. But the latter, unfortunately, does not contain a single altitude ! For the purposes of this paper I have therefore fallen back on the R.G.S. 1 in 5 Million map prepared in 1918 for General Smuts' lecture, on which I have endeavoured to correct certain portions in accordance with my own recent surveys.

Orographical Features.—That our area, belonging to the major geographical unit of High Africa, has participated to a great extent in the process of fracturing which has made East Africa the classical ground for the study of Rift valleys, there can be no doubt. That the Nyasa trough is a Rift, that the great and sudden drop east and south-eastwards of the high plateau into the coastal foreland is intimately connected with great fault-lines, who can deny ? But in the absence of strictly geological proofs, it is by no means easy, it is even in many instances distinctly premature, to base one's conceptions of the country's tectonics on purely morphological features of the present day. Is a high mountain wall rising in clear-cut lines from a vast expanse of lowland a fault-scarp, or is it an erosive escarpment ? How often is the African geographer faced with this dilemma and how often does he succumb to the temptations of a pre-conceived theory ! How rarely, too, when listening to opposing statements about one and the same feature, does one meet with an instance of an explorer having realized the fact that fault-scarps of such tremendous height must of necessity have taken a very long time to develop, and that throughout all that time, and from the very beginning, erosion has played on the gradually appearing front of the up-standing crust-block ! Only patient and painstaking detailed mapping will provide the clue for deciphering the historical evolution of the forms which we see to-day ; and in the meantime we should take the terms " scarp " and " escarpment " *cum grano salis*.

The northern part of South-West Tanganyika Territory is taken up by the high-plateau block of Uhehe, Ukena, and Ukinga. North-westwards this block drops either in steep scarps or by more gentle surface forms to the high-lying upper basin of the Great Ruaha, whilst east



South Uhuguru Mountains

Phot. R. W. Norton



Mt. Yunge, East African scarp

Phot. C. Gillman



Hot springs near Moeta

Phot. R. W. Norton



Embouchure of Ruaha gorge

Phot. R. W. Norton



Lowest part of Ruaha gorge

Phot. R. W. Norton



Udzungwa highlands

Phot. C. Gillman

and south-eastwards the great East African Scarp towers beautiful and high above the southwards ever-widening strip of the coastal hinterland. This latter, in itself a region of very varied relief, still includes in places residual plateau masses which, like the Uluguru and Mahenge mountains, rise as outliers of the central crystalline plateau from a rough but on the whole much lower surface of old and new sedimentary formations.

Crowned, especially in its southern parts, by magnificent rain-forest which is nourished by the moisture precipitated from the air of the prevailing south-east trade winds when it strikes the cool upper edge of the plateau, breaking down in steep slopes or rocky bluffs, this great scarp forms for hundreds of miles a formidable barrier to east-west communications. Indeed, the linking up of the coast with the vast plateau-lands between S. lat. 5° and 9° , and thereby the tapping of lake Tanganyika, has only been made possible by the existence of the one narrow gap in this otherwise uninterrupted mountain wall, found in the mature valley of the Mukondokwa. Obviously a relic of pre-scarp morphology, it has, with its easy grade and well-advanced stage of erosion, not only pointed the way westward to the old slave traders, but has also determined the alignment of the Central Railway trunk line. The only other gap, the geologically very young, narrow, and steep-sided transverse gorge of the Ruaha, 100 kilometres farther south, is not only quite impracticable for modern means of communications, but does not even afford room, between its cliffs of sheer rock and the tossing waves of East Africa's longest river, for a primitive native path.

Conditions, however, change markedly and quite suddenly where, at about 9° S. lat., this great scarp takes a decided turn to the west and gives way to surface forms which, whatever their morphological history may have been, are now undoubtedly those of a typical erosive escarpment. Five great streams—Kihanzi, Mpanga, Mnyera, Ruhuje, and Pitu—a veritable East African "Punjab," combining to form the Kilombero, and gnawing with their countless tributaries deep into the southern tableland, have succeeded in turning the former high and almost level ground for 100 kilometres west and south into an amazing mass of ridges and valleys. But although the result is a general slope of the country from the foot plain to the rolling uplands far more gentle than that of the scarp further north, the work of erosion has nowhere advanced sufficiently far to carve out a second Mukondokwa highway, all the valleys being still in an unripe state, with gorges and frequent rapids in their middle courses.

Seen from above, from the eastern edge of the Ubena peneplain, what a tremendously vigorous dissection! Geographically, erosion approaching maturity, the ridges on the whole still flattish, but valley-density almost at its maximum, and slope-erosion eating rapidly into the divides. Emotionally, an awe-inspiring multitude of valleys, large,

medium, small, with the intermediate backs at a practically uniform level, hardly a bush, four or five trees in 100 square kilometres, grass and bracken covering as far as the eye can gaze an endless vista of valley upon valley!

The peneplain itself, or what not long ago must have been a peneplain, extends westward for about 30 kilometres, rising only 130 metres, until it abuts on more hilly ground, the last gentle eastern waves of the Livingstone ranges melting imperceptibly into the plateau step.

Farther north, beyond the headwaters of the Ruhuje and Mnyera, the flat softly undulating country merges, slightly rising, into the similar ground of southern Uhehe, and towards the north-west it is drained by the valley of the Mbarali into the great plain of the upper Ruaha, the so-called Usangu Plain. Here, though, the topography at the foot of what looks like a gigantic scarp by which the northernmost and highest portion of the Livingstone Mountains breaks off in the east, becomes once more markedly accentuated. But it would seem as if the maximum of valley density had already been surpassed, that erosion is in a far more advanced stage than farther east in the drainage area of the upper Ruhuje. This is not surprising, as the basis of erosion is the Usangu Plain, which lies only 1000 m. below the central Ubena plain—the Kilombero-Ruaha Divide lying here at approximately 2050 m.—whilst the drop to the Kilombero attains nearly 1700 m. But quite apart from general considerations of drainage, the morphological detail of the slopes also points towards a more mature stage of erosion. While the lower and middle slopes are as a rule gentle, the higher slopes of the generally well-curved, often narrow ridges, show everywhere much outcropping rock, a peculiarity which can best be explained by increased removal of the deep residual soil, a removal which, *e.g.* in the Ruhuje drainage, has only just commenced. But this more mature stage notwithstanding, the valleys are still decidedly deep and often form falls.

If we now turn westward we find the remains of a former mountain system superimposed on the plateau. Gentle, much-denuded ridges first, and then chain upon chain of hills, each succeeding one a little higher, and all with the tendency to increase in height towards the north, where altitudes of over 2900 m. are attained. These are the famous Livingstone Mountains, which, contrary to Thomson's conception, are an individual unit, orographically as well as geologically, and not merely the higher parts of the old plateau. For while the latter in this region consists of a great granitic laccolith which probably has something to do genetically with the forming of the Livingstone Mountains, these are composed largely of ancient highly metamorphosed schists, capped in places by little disturbed and likewise very old though not metamorphosed shales and sandstones.

In their central portion they still show senile forms; but as we proceed west each day's march leads through ever more accentuated, ever

more picturesque scenery, until one day we step on to their western edge, and thence obtain views which are not only most instructive from the geographer's and the engineer's point of view, but must be counted among the finest the world can offer. From one's feet the terrifically steep slopes drop away, forming a foreground of the wildest mountain scenery; in the south this foreground of rocky cliffs dips into the great lake; whilst in the north, separated from the sand-dunes of the northern shore by the flat stretch of delta country far down in the wide trough, rises a volcanic landscape of cones and ridges which culminate in the noble lines of Mount Rungwe; and beyond in the far west rises a similar, though somewhat lower scarp from a sea of mist and cloud.

Geographically, this combination of typical scarp and typical volcanic topography, side by side, with the great lake and its shore-lines thrown in as a feature of additional interest, forms an object lesson of so wide a scope that it seems impossible to find its equal anywhere else on this Earth. And to the engineer anxious to link up Nyasa with the outer world, the tremendous natural difficulties awaiting such a scheme are once more, and more plainly than ever, brought to notice. From Manda Bay, just discernible on the far southern horizon, up north along the long unbroken line of the Livingstone scarp, then sweeping west and formed by the volcanic masses of Rungwe and the Mporoto chain, and finally completing the circle by the long southward trending scarp of Bundali, an uninterrupted, tremendously steep and horribly cut-up slope of an average height of 1500 m.!

To this difference of height one must add the climatic factor of the large lake which, under the heat of a tropical sun, forms a great natural reservoir for a constantly circulating stream of water, rising to-day in the form of vapour to be re-condensed on the cool upper slopes and to re-descend to-morrow with tremendous force, facetting on its way the slopes of the vast amphitheatre into knife-edge ridges and deep ravines.

It is no exaggeration to say that by the sharpness of its features, the steepness of individual slopes, this scarp scenery surpasses Alpine morphology, although once more one cannot help being surprised at the comparative rarity of naked rock. I have actually measured slopes of 75° which still retained their residual covering of clayey red or brown earth. On the other hand, it is well worth noting that the average slope of the scarp as a whole is by no means as steep as one might think when either facing or climbing it, or looking down it from the top. Several clinometer measurements taken along a distant cross-section on the steepest part between the north end of the lake and the Ruhuhu delta, have revealed the astonishing fact that the fairly even slope from the top edge to the bottom seldom, if anywhere, exceeds 30° .

As already stated, great volcanic masses form a very serious obstacle against access to the lake from the north. They have risen over the shattered crust at the point where the Nyasa Rift branches into its two

daughter rifts, that of lake Rukwa trending north-west and that of Usangu running north-east and joining up, very probably, with the Great East African Rift Valley. This volcanic blocking of the road has, to judge from quite recent statements, not always been realized, although it is a feature of the greatest importance. For the Mporoto chain, a more or less level volcanic ridge stretching east-west from scarp-edge to scarp-edge, and breaking down in a great curved and much-dissected slope towards the south where Ntukuyu and Konde Land lie, would force any road or railway attempting to reach the lake from the upper Ruaha, to climb to at least 1900 m. (the lowest point on the ridge which here forms the Rufiji-Zambezi Divide), and would thus handicap such a line with a loss of level against export of more than 1400 m.

Thus the great Nyasa trough, sunk deep into the old Central African Plateau as a consequence of comparatively recent and large-scale tectonic happenings, lies carefully guarded against the inroads of civilization. Only at one point the guarding bulwarks of the north and east appear vulnerable. This is the Ruhuhu depression of which more will be said presently. Here a word must be added with regard to the geographical peculiarities of the lake itself as a line of communications.

When looking at a small-scale map one is easily lured into a comparison of the great Central African lakes with other large sheets of water which, like the North American lakes, have played so important a part in the commercial and industrial development of the countries around them. The railway man in particular is attracted by these long stretches of navigable water on which—on the map—he sees hundreds of miles of extremely cheap extension of the zone of economic influence of his railways, once the latter have actually touched one or the other of the lakes at a single point. When studying the question, however, face to face with geographical actualities, one realizes the futility of such comparisons and hopes, as soon as the difference is perceived. While the North American lakes are surrounded by country which slopes gently towards the water-filled depression, thus affording ample opportunity not only for human settlement and industry in the immediate and wider vicinity of their shores, but also easy access from distant inland areas, our African rift-valley lakes and especially Nyasa (though Tanganyika is not much better) lack all these advantages. Their steep slopes leave little room for settlement along the coast, and communication with the surrounding high plateau country is, if at all, possible only by difficult and circuitous routes.

To return to the great plateau-block of Uhehe-Ubena, whose eastern edge we have followed as far south as the Ruhuje. Immediately to the south of that river a long and high spur of the plateau, jutting out in a south-west-north-east direction, forms a very distinct mountain range, 60 km. long, 40 to 50 km. wide at its base, and rising to an average

height of 1300 to 1400 m. This Pitu Range, as I will call it from its chief river, which has so far appeared on no map, thus joins the outlying mountain group of Mahenge (always up to now described as a *horst*, or an isolated mountain island) to the main plateau. There is no trace of the wide open valley of the Pitu which the topography as depicted on even the latest maps led one to expect. The river is there right enough, but its middle course is a narrow tortuous transverse valley, assuming in its central portion the form of a veritable gorge by which the Pitu Range is pierced. Thus—and this is an important point—that range does *not* form the divide between the Rufiji and the Nyasa-Zambezi as its general trend and altitude might suggest. The actual divide lies somewhat to the south of the south-eastern foot of the range, in a geologically much younger formation, and with a pass only just over 900 m. above sea-level to which the Pitu valley forms an easy graded access. The descent from this low divide into the Ruhuhu depression and through it to the eastern shore of lake Nyasa is quite a feasible proposition.

The existence in this out-of-the-way corner of a typical transverse valley whose river leaves a vast east and west comparatively low-lying area of soft (probably Cretaceous) terrestrial sediments, in order to break through hard and lofty crystalline mountains in a south-north direction, is sure to alter materially some of our present conceptions of the geomorphological history of this part of Africa. It is, in my opinion, not only a very excellent proof of a considerable down-faulting which resulted in the formation of the great Kilombero plain as a huge bay between the main scarp of the plateau and the Pitu-Mahenge spur; but it shows plainly how, through this very pronounced lowering of the base-level, a former west-east drainage which gave rise to the great accumulation of Cretaceous sediments, has been partly diverted at a right angle through capture by the Pitu.

To-day this Kilombero plain is a vast mountain-framed expanse of perfectly flat alluvial lands which rise imperceptibly from about 210 m. above sea-level in the east to 270 m. in the west at the foot of the Ruhujemnyera escarpment. Extremely well watered by countless permanent streams, which descend from the encircling highlands and swell the greatest East African river, that meanders sluggishly in a deep clayey bed through the endless grass-steppe, this plain has for long appealed to geographers and administrators, both British and German, as a future granary of East Africa. But a closer investigation has revealed the necessity for a far more accurate and reliable study of its soils, before a final opinion can be formed on its potential value as a cotton and rice producing area. For at present cultivation takes place only on that truly wonderfully fertile riverine and deltaic land which, in narrow strips, accompanies parts of the upper main river and all the larger tributaries. Here it forms slightly raised areas flooded annually for a

few days at highest flood by running water from which is deposited a much coarser and much more valuable silt than from the stagnating flood water that covers huge surfaces and deposits a very heavy not arable clay. The broad, flat, and very gently inclined alluvial fans which descend from the foot of the hills into the inundation area between every pair of tributaries, consist of markedly sandy loam, and are probably due partly to intermittent runnels and mainly to the great "sheet floods" so common in regions of tropical rain. These fans are to-day quite uninhabited and uncultivated.

If we now turn south-west from the low divide, we find that the young sandstone and marl plateau into which the easternmost affluents of the Ruhuhu are gradually cutting their valleys, soon gives way to a different formation. At about $35\frac{1}{2}^{\circ}$ E. long. we enter a wide and low depression which runs due west between much higher ground, and is filled to a height of 400 to 500 m. above lake-level by hard sandstones, shales, and limestones of the Karroo formation. It is, especially in the west, a shattered area of small individual crust-blocks, where the rapid erosion of the Ruhuhu and its many tributaries is maintaining steep boulder-strewn slopes interrupted by many short stretches of gorge-like valleys.

This depression is cut through the southern narrow part of the highland plateau about midway between the north end of the lake and the Portuguese border. In the south-east one rises gradually from it to the comparatively low plateau of Ungoni, with its superimposed residual granite ridges, from which spring the source-streams of the Rovuma. In the south-west the mountain wall which closes in the depression, and which is dominated by the sheer cliffs of Namtshweya's mighty twin-pyramid, has all the aspects of a fault-scarp forming the northern edge of the fertile Matengo block; whilst the north side of the depression consists of the wild and intensely dissected escarpment by which the Ubena block slopes southward. To me there can be no doubt that this Ruhuhu depression is a feature very considerably older than the Nyasa trough by which it, together with its Karroo sediments, has obviously been intersected; and that, whether we look upon it as of tectonic (which I consider more likely) or of erosive origin, we have in it a further proof of an ancient west-east drainage.

The Ruhuhu is a fine broad river at its mouth, and a little to the north lies the beautiful and comparatively sheltered bay of Manda, framed by fine sandstone hills, the obvious and only terminus for a railway from the east. As already observed by Bornhardt (in April), I found that during the rains, owing to its colder temperature, the muddy water of the Ruhuhu disappears immediately in front of the mouth, leaving the warmer and clear water of the lake surface undisturbed. But in November, when the comparatively shallow water of the river at its lowest has approximately the same temperature as that of the lake, I

noticed a streak of brownish-yellow water reaching a good kilometre or so out into the open and being blown a good way northwards by the prevailing southerly winds.

In the north-west corner of the lake lies the open beach of Mwaya, where, at reasonable cost, sufficient shelter can be provided, and thus a port be created for the densely populated fertile and beautiful Konde Land. Thomson called this land Arcady, and so it is when it does not happen to rain! It has often been described with its carpets of luxuriant pasture, its banana groves, its exceptionally clean villages and artistically built huts, rising from the tropical plain by the lake to the almost temperate climate of Ntukuyu, from whose cosy though somewhat earthquake-shaken bungalows this finest district of the Territory is administered. But I must once more emphasize the wonderful variety of its scenic beauty, created by the juxtaposition, and in a degree by the gradual melting into one another, of two such strikingly different surface forms as the overwhelming scarp topography comparable to walls of cut emerald, and the more quiet yet in their own way equally impressive lines of the great volcanic masses. Add to this the far southern horizons with the grand sheet of blue water disappearing between the dwindling crags of its mountain barriers, and the changing lights produced on slope and valley by the continuous play of its vapours, hazy mists now, delicate streaks of cloud a little later, or, in the evening, towering cumuli of white and gold and blackish-purple, and you will readily perceive what Konde Land has in store for the lover of Nature's beauty.

Dominating the scenery from whichever side one arrives, are the graceful lines of Mount Rungwe, rising from between the sheer walls of the scarps. And this highest of the Nyasa volcanoes deserves a few remarks. The apex of what looks from the south like a beautiful cone is in reality merely the most elevated southern point of a wide crater rim, a regular somma, the remains of which form the present Rungwe chain. This somma still exists well preserved, though of uneven height on the south, east, and probably north side of the large crater, whilst the whole of its western side has been blown off. The *atrio* is well developed and just below the summit is 600 to 700 m. deep. There are two large central cones, rising to heights only little less than that of the highest point on the somma, and it is these two cones which one sees as the second and fourth elevation from Ntukuyu, the third being a high point on the north-west side of the somma. As the western part of the somma is missing, the western slope of the present massif is formed by the western slopes of the two central cones, and the *atrio* is drained by two deep and narrow gorges westwards. As far as just beyond the southern cone the topography as described is plainly recognizable from the summit, but beyond, as its details are partly hidden by that cone, one cannot say with certainty if the two cones actually stand in the same crater or whether the mountain consisted originally of two separate

craters which have eventually grown together, each with its one central cone.

The altitude of the so-called "Siga Mbili," the highest point, my boiling-point observations, checked by trigonometrical measurement, make 2990 m., which is nearly 200 m. less than the figure on the official map (*vide* "Note on the Altitude of Rungwe," below). The mountain had probably been ascended for the first time by Kerr-Cross in 1891. Then followed Elpons in 1898, while Goetze and Fuelleborn traversed the chain in 1899. The first to climb after the British occupation were Major A. E. Perkins and Capt. C. N. Wedge, of the King's African Rifles (in June 1922), and my wife and I reached the summit early in January this year after six hours' climbing from Ntukuyu. There are, of course, no difficulties beyond the steepness and the denseness of the bamboo on the upper slopes.

At a little more than half height, approximately at 2100 m., a large parasitic structure protrudes from the otherwise fairly even flank of the mountain in a south-easterly direction; and this unevenness, the Lusiba Crater of the 1 in 100,000 map, proves on inspection to be a twin structure consisting of two craters, not one as shown on the map: a smaller lower one, which contains an apparently permanent lake, and a much larger upper one. These craters are separated by a deep narrow valley running south-east. The upper crater is surrounded by a rim only for about two-thirds of its circumference, the remainder of its walls being formed by the slope of the main mountain, with the result that the *débris* from those slopes have succeeded in silting up the crater bottom. It therefore contains only a large swamp now, with very little open water; and the level of this swamp seems, furthermore, to have been lowered quite recently by backward erosion on the south-east slope, which has eaten a large and quite fresh gap into the crater wall at its lowest point. The lower of the twin craters, on the other hand, whose southern rim is the almost horizontal ridge so plainly visible from Ntukuyu, seems to have its whole wall still intact. Kerr-Cross's statement (*Geogr. Journ.*, 5, 1895, p. 116) that "the lake occupies a hollow on the summit, 500 yards below the rim of the crater," is thus not quite correct.

The Nyasa-Tanganyika Plateau, the eastern portion of which belongs to the Nyasa Rift and therefore to the area under discussion, I have unfortunately not had time to visit. It is a broken-up highland which drains northwards into lake Rukwa, and south-eastwards into the Songwe River, whose valley, according to a German railway reconnaissance, would seem to afford a feasible access from lake Nyasa to Fife in N.E. Rhodesia. The available reports on this country are very contradictory, descriptions of its general aspect ranging from "paradise" to "desert." But all authors seem to be agreed that from the easternmost mountainous parts which still benefit by the moisture from the lake, the



Central Livingstone Mountains

Phot. R. W. Norton



Mountain forest in Udzungwa highlands

Phot. C. Gillman



Typical tributary of the Ruhuhu in Karroo area

Phot. R. W. Norton



Manda Bay, Lake Nyasa

Phot. R. W. Norton



Lake Shore, Manda Bay

Phot. C. Gillman

Dudley Peak



Manda Bay, Lake Nyasa

Phot. R. W. Norton

country westwards becomes rapidly drier and more sterile, with steppe vegetation dominating.

It is as well, at this stage, to recapitulate the outstanding orographical features of South-West Tanganyika Territory :

(1) In the main the area consists of the southwards-narrowing and most elevated part of the great East African High Plateau, into which the deep Nyasa trough is sunk.

(2) Eastwards a mighty step, 1500 to 2000 m. high, forms an effective barrier to modern communications for $3\frac{1}{2}^{\circ}$ of latitude, from the Mukondokwa valley in the north, through which the Central Railway reaches the plateau, to the Ruhuhu Depression in the south. Only where about midway, the Kilombero source rivers have worn down the sheer scarp into an easier yet vigorously dissected slope, can the highland of Ubena be climbed, though not without considerable difficulty.

(3) The East African Divide, *i.e.* the watershed between the coastwise drainage of Northern East Africa (including the, at present, dischargeless eastern sunklands) and the lake-filled sunklands of the central plateau, lies throughout East Africa on this plateau itself, generally at roughly 2000 m. above sea-level.* At about 10° S. lat., however, this divide dips down in a big easterly bend to the level of only 900 to 1000 m., and then runs for some distance on the sedimentary formation of the foreland until, west of Songea and south of the Ruhuhu Depression, it reascends the archaic block of Matengo.

(4) The remarkable transverse valley of the Pitu, pierced through a high plateau-spur which terminates in the Mahenge Mountains, affords an easily graded access to the lowest point of this East African Divide from which the Pitu river springs.

(5) The low depression of the Ruhuhu drainage leads by gentle grades from the low divide to lake Nyasa.

(6) Towering above the north end of the lake, the volcanic Mporoto chain, with no pass lower than 1900 m., fills the Nyasa trough from edge to edge, thus forming a formidable obstacle to communications between Konde Land and lake Nyasa in the south and the wide open plateau-basin of the upper Ruaha.

Geology.—My geological harvest, including nearly 500 rock samples, still awaits detailed elaboration. But as I have been able to add a new traverse through hitherto geologically unexplored country, it is perhaps permissible to indicate where my observations are likely to alter the latest geological map. This traverse runs roughly along the meridian in $35^{\circ} 40'$ E. long. from the Ruhuje river in the north, where it crosses Scholz's route of 1913, to Songea in the south, where it meets those of Bornhardt and Dantz.

* One of the few exceptions is the comparatively low area near the southern end of the East African fault-step where, not far west of Kilimatinde, the Central Railway crosses this divide at an altitude of only 1340 m.

The section first cuts through the gneisses of the Pitu Range; and from the upper end of the Pitu gorge, right across the East African divide, and through the upper (eastern) portion of the Ruhuhu Depression it remains almost throughout on the low plateau, which consists of soft friable sandstones and marls with banks of coarse conglomerate at its base. In the north these terrestrial sediments of comparatively young (probably Lower Cretaceous) age rest unconformably against the archaic scarp which here forms the left side of the upper Pitu valley, striking south-west-north-east, *i.e.* practically in line with the Mbarika scarp farther east, from where Scholz describes similar conditions. Only at and near the Hanga-Rutukira confluence has this formation been denuded down to the upper karroo of the Ruhuhu basin. The petrographical difference between the younger friable sandstones and the hard grits and limestones of the karroo are so striking, and their influence on surface forms so obvious, that the line of contact can easily be followed in the field. The younger formation, which on the latest geological map is shown only as far as the Luwegu river (about 60 km. farther east), actually reaches west to the Lumezi valley. Petrographically it would seem that this formation closely resembles, if it is not identical with, that recently discovered across the lake in north-west Nysaland by Dr. Dixey, where it contains Dinosaurian beds.

About 20 km. south of the Hanga along the Songea road, hard limestones, typical of the uppermost karroo, crop out and lie against phyllitic schists and quartzites. These latter, after a further 10 to 15 km., give place to the archaic rocks of the southern plateau block against which they rest; to decide whether or not they are down-faulted will require extensive field work. Similar outcrops of old highly metamorphosed sediments, including iron-quartzite-schist of the itaberrite type, have been observed by Dantz and myself in various localities along both the northern and southern margins of the Ruhuhu Depression. Wherever they occur they lie between the karroo and the archaic wall.

The south-west of Tanganyika Territory contains four fair-sized areas of karroo: at Ruhembe, at the foot of the great scarp about 100 km. south of Kilosa; in the Ruhuhu Depression; on the lower Kivira river near the north-west shore of Nyasa; and finally high up along the Malila scarp across the Nyasa-Rukwa Divide. From the first three coal has been reported, but only the karroo of the lower Kivira is known to contain seams of exploitable quantity and quality.

Enormous masses of high-grade magnetite crop out on the top and sides of Ligunga ridge in Upangwa, only about 50 km. due north from the Ruhuhu, and throughout the Upangwa escarpment and the southern Livingstone Mountains magnetite in small outcrops is of frequent occurrence.

With regard to more valuable minerals, above all copper, the formation of ancient schists which builds up the bulk of the Livingstone

Mountains is closely allied to the highly mineralized formations of Katanga, so that, if anywhere in Tanganyika Territory, here is the place where one might still hope for the realization of that dream of mineral wealth which permeates the brains of many. Personally, I am pessimistic.

Climate.—Although our area lies entirely within the climatic province of the south-east trade winds, which is characterized by one long rainy season lasting, generally, from the end of November to the beginning of May, it is obvious that the great changes in altitude and, in the west, the proximity of the great lake, must lead to marked local variations of climate. I will touch here only on the economically most important meteorological factor—rain. The low lands at the foot of the great scarp and the Ruhuhu Depression receive between 750 and 1000 mm. annual precipitation. On the bulk of the plateau this increases to 1500 mm. and more, while the chains of the Livingstone Mountains and the volcanic area of upper Konde Land get up to 2500 mm. of rain per annum. Lower Konde Land with more than 2500 mm. is one of the wettest corners of East Africa, and here, as well as in upper Konde Land, there is hardly a month without rain. Beyond the Mporoto chain, which is also a serious climatic barrier, in the Rukwa and upper Ruaha basins, precipitation drops suddenly to 750 mm. and less, and tropical luxuriance of vegetation dwindles into arid steppe. Remarkable in the mountainous country around the northern part of the lake is the extraordinary frequency and force of the thunderstorms, which are sometimes accompanied by hail. During my travels we had at least one—often a series of storms—every afternoon without exception from November 12 to February 25.

If thus there is a very marked difference in actual precipitation between low and high lands, the orographical peculiarity of much of the area, chiefly the close proximity of high and low due to the steep and high scarps, as well as the water-storing property of the forest vegetation on the upper slopes, render at least the marginal strips of the lowlands very well watered for East African conditions. And the sudden drop of large perennial streams descending from the plateau edges to the surrounding sunk lands represents a very noteworthy accumulation of potential water-power which may, one day, lead to intense development in a direction hardly as yet foreshadowed.

As European settlement of the Kenya type has of late been frequently advocated for the southern plateau, it seems necessary to point out a few important geographical differences. First there is that of latitude, amounting to fully 9°, which, with the altitude approximately the same, must by itself result in increased inclemency of climate. This is further aggravated by the prevailing south-east wind which, in the south summer, sweeps the eastern and central portions of Ubenia as a bitter, biting, and continuous blast. But chief of all there is the steady evaporation from the great lake, from which the Kenya highlands are quite free, but which renders the western parts of the Nyasa highlands

extraordinarily damp, misty, and cloudy: fair average figures in this connection are those observed at Tandala Mission station, which show relative humidity at an annual mean of 78 per cent. with a monthly maximum of 90 per cent., and cloudiness at 67 and 78 per cent. respectively. If one adds to this the nerve and heart-affecting influence of continuous life at low atmospheric pressure, the entire absence over enormous stretches of the rolling uplands, of forest and therefore of firewood and constructional timber, and the fact that notwithstanding their altitude these highlands are by no means free from tropical enemies of men such as anopheles and spirillum tick, one must, I think, agree that the southern highlands are from a climatic point of view not exactly a settlers' paradise. That these drawbacks of climate must also affect plant-growth unfavourably goes without saying, and the fact must not be overlooked that practically throughout the more easier ploughable slopes of these highlands the land has at one time or another been under native cultivation, so that virgin soil does no longer exist, and costly artificial manuring will have to be resorted to by the European settler from the start.

Vegetation and Landscape.—Anything approaching a detailed description of vegetation types over so large an area being out of the question, I shall restrict my remarks to a few glimpses of typical scenery. And I shall attempt to show how plant-life, together with the surface forms it covers, and dependent on the changing conditions of the atmosphere, influences landscape. For the great charm of this south-west corner of Tanganyika Territory is due to the fact that landscape changes rapidly in whatever direction one marches, while over hundreds of miles both in the coastal foreland and on the peneplain of the central plateau it maintains a tiring monotony.

Take first the scarp foot, a narrow strip of rich brown soil, which carries the native villages separated by savannah forest of exceptional luxuriance. Mountainwards this merges into true mountain forest, whilst outwards, towards the great inundation plains, it soon degenerates into tree and bush steppe, and that again into open grassland. At frequent intervals permanent streams take their final leap from the lower cliffs of the scarp, and their rocky beds are shaded by giant trees, outposts of the upper forest which often accompany the narrow margin of permanent moisture far out into the steppe. In places new clearings lie thick on the middle slopes, patches of yellow amidst the sombre green. Mountain rice, which does not require irrigation, is grown here for a few seasons whilst the virgin soil lasts, and then new patches are cleared under a system of criminally wasteful husbandry which carries with it the germs of rapid desiccation. North of the Ruaha, where the population of the mountain slopes is much thicker, one can already see the result in the shape of bush and grass-covered slopes, with the last forest remnants hiding in inaccessible glens.

In the great alluvial plains, subject to long-lasting annual inundation, of which the Kilombero is a splendid example, grassland, rarely interrupted by a solitary *Borassus* palm, dominates the central portion of heavy clay. The gray loams of the alluvial fans are the domain of the bush and higher up of the tree steppe, which pushes out in great lobes into the sea of grass. It is a wonderful scene of African grandeur when viewed from one of the foothills, this endless flat steppe, a mosaic of green and yellow, gilt by the reflection from the evening sky, from which it is separated by the dark purple bar of encircling mountain cliffs. It is a hopeless waste of stagnating water and swamp for several months after the rains, and yet I have had camps in the Kilombero during the dry season from which my men had to walk an hour to the nearest miserable water-hole!

By a few hours' stiff climb, however, we are lifted into a different world. At about 900 m. above sea-level the xerophytic savannah forest ceases on the steep slopes of the south-west scarp. Then follows, up to approximately 1400 m. a very extensive belt of bracken, with an occasional cluster of bush or stunted trees, to my mind a natural formation and not, as is often maintained, the result of human agency. I do not, of course, deny the indisputable fact that wherever in these altitudes new forest clearings are abandoned, this quickly growing and easily spreading bracken jungle takes possession of the ground and thereby increases the total area of the bracken zone. But I do maintain that this zone has always existed as a natural plant community; and nowhere is the evidence more striking than in the Udzungwa Mountains. The natives, too, declare most emphatically that the bracken was there long before man, that it is "the work of God."

The Udzungwa rain-forest is magnificent, and in its uppermost reaches where it dissolves into isolated groves of dark verdure separated by patches of bright meadow or of the dark reddish-brown of newly tilled land, it forms a landscape of fascinating beauty. Especially when the mists of early morning bring out to perfection the relief which, near the edge, changes from the peaceful gentle valleys of sluggish plateau streams to wild erosive cirques and gorges with their tumbling waterfalls, from bold rocky eminences to stately straight-lined ridges. And from everywhere one catches glimpses of the vast sweltering Kilombero plain, 2000 m. below one's feet, which by contrast help to emphasize the loveliness, the refreshingly crisp air of this mountain scenery.

In the deeply eroded valleys and gorges of the East African "Punjab," of which the Pitu is a fair representative, the vegetation is typically xerophytic: bush steppe in the wide flat debouchures, stunted and sparse savannah of the *Brachystegia* (Myombo) type on the low hills which fill the main erosive depressions with a terrifying maze of topographical detail, and denser savannah on the higher slopes, where in exposed positions, even as low as 800 to 900 m., the trees are often thickly covered

with lichen.' Of considerable interest is the fact that the Masuku tree (*Uapaca Kirkii*, Masukulu of Nyasaland), which in the Nyasa basin often replaces the *Brachystegia* in the savannah formation, crosses the low ridge of the East African Divide and only stops at the southern foot of the Pitu Range. (The tree is, however, also reported by Fuelleborn from the Uhehe plateau and Central Usagara.) The stands of this tree, whose fruit is a welcome addition to the natives' diet, resemble from a distance the groves of chestnut on the Italian slopes of the Alps, and were felt as a great relief after the long days in the Myombo. And so was the reappearance of the *Borassus* palm and of the few great sycamores in the valleys of the Cretaceous low plateau. But above all, as a man and more so as a surveyor, one breathed freer on emerging after days of toil from the Pitu gorge with its cataracts, its depressing slopes, its pathless wilderness, when one's eye rested again on distant horizons after the more than restricted views of a tortuous, winding bush-filled notch-valley.

Endless savannah, only rarely interrupted by a miserable native clearing, stretches far and wide east and south over the Cretaceous formation. Marching is made tedious by the deep sandy soil of the flat broad ridges and by the swamps in the trough-shaped valleys, which seem much too broad for the tiny dribbles of water that drain the low and dry divide westwards. So one is glad to approach at last Central Ungoni around Songea with its hard red residual soil, its pleasant valleys breaking from scattered granite crags and tors to form the Rovuma. It is a country of delightful wide vistas where a thick population has created that artificial and pleasing form of vegetation which is so well expressed by the word "culture-steppe."

Quite different again is the vegetation in the Ruhuhu Depression. Furthest removed from the Indian Ocean and on the leeward side of the divide, protected too, to a large extent, from the moist Nyasa winds which blow south-north, *i.e.* past the entrance of the west-east running depression, its climate is drier than elsewhere in the south-west. And the soil formed by the weathering of the karroo shales and sandstones is poor. Thus it is not surprising to find large areas covered by thorn-bush with occasional doum palms, and the savannah restricted to higher parts of the clumsy-looking sandstone ridges. The Baobab, too, which had been left behind on the Ruvu-Rufiji divide near the coast, reappears on the middle Ruhuhu, a pioneer from the steppes of the Zambezi.

Even along the many permanent rivers which descend from the bordering mountains the usual marginal forest is of very poor type, a marginal bush rather, and often that also is lacking. In the dry season such parts make one realize once more that old but ever new contrast so characteristic of the more arid mountain regions of East and Central Africa: great masses of life-spending water tossing down rocky riverbeds, and only a few yards away the dead valley slopes scorched and barren. But when gay with the many tints of short-lived African

spring, tints ranging from brown and orange to the brightest, freshest green, with an occasional spot of crimson foliage; great white and grey clouds above, with here and there a window into the blue sky—then this mountain-framed country of flat-topped hill and rock-floored gorge, opening out on to the blue lake and its cloud-capped western scarp, has a rare beauty of its own.

To the north of this arid land the slopes of Upangwa rise in an endless succession of chains and valleys to the southern Ubena plateau. My course lay diagonally across this most fascinating country which, so far, has never been described in geographical literature. It is well worth a description and a much closer study, not only for reasons of its intrinsic beauty, but because there I can see a land which might well carry contented white settlers. I hope to get together before long a short monograph for publication in the *Journal*; in the meantime a glance or two, taken from my diary, must suffice:

"We are camping at 1500 m. above sea-level, in the heart of Southern Upangwa. We have left far below the sandstone hills of the Ruhuhu and are screened from the blue lake, after many a parting glance on the way up, by the great towering ridges of the southern Livingstone spurs. We have risen steadily for two days and are in an enchanting land. Noble hills rising to 2000 m. shut in the pleasant and peaceful valley in which we lie. The new grass is just sprouting after the first showers, and the slopes are clad in the softest of velvety green, studded here and there with a purple cluster of budding acacias, or a white boulder, and all this green and purple and white is spanned by a brilliantly blue mountain sky. The bracing air in spite of the hot sun, the wide vistas—they all make walking and climbing most pleasurable."

"The farther we penetrate into this wonderful mountain land the more beautiful it becomes, in its spring garb, with lovely flowers to gladden the eye. One night we camped at the foot of Nyamadote, whose rocky cliffs and couloirs remind one of the Dolomites in the rosy light of the parting sun. From there a stiff climb of three hours took us up to the real highlands, by no means a plateau as yet, but markedly less dissected than the long stretch of slope we had traversed on our way up from Manda. It is a glorious country of velvety downs, with quite large patches of forest, covering a rounded knoll here or pushing a dark green tongue down a little glen there; and there are wide horizons across fine chains of hills and valleys resounding with the peaceful tinkling of cow-bells. And beyond the deep broad valley of the Luwana from where we had come, one looks on to the great chain of bluffs behind which rise the vapours of Nyasa in big towering cumuli or in creeping, sucking mists."

Through such country one gradually rises to the southern part of the plateau proper where the last dying waves of the Livingstone Mountains break down into the soft forms of the penepain. Three types of vegetation dovetail here continuously one into the other, the dovetailing following closely the lie of the ground. On the tops of the ridges and on their

higher slopes, as well as often descending tongue-like into the uppermost valleys, grows a tree formation, evergreen and dense, which however except on the highest chains cannot, as a rule, be called otherwise than temperate mountain bush. Where this bush has been removed by human activity, and that is the case over wide areas, bracken scrub and low open bush spring up as soon as cultivation has ceased. The rest of the country is low grass steppe of the purest type, hardly interrupted by any bush or tree, and undoubtedly a natural formation, *i.e.* not the result of the removal of the forest by man. Here, where both types of open vegetation can be studied side by side, it becomes very easy to decide what is natural and what is secondary plant formation. On very rare occasions when the path dips into an exceptionally deep valley, one finds the savannah of the lower regions encroaching on the plateau vegetation, the highest limit of the savannah lying at about 1750 m. and its uppermost fringe consisting of very open and stunted stands of *Uapaca* and *Brachystegia*.

The mountain steppe, especially when framed by some rocky heights as on the Mahanga Pass and when seen in flower, reminds one very much of the meadows of the Fore Alps, and the swampy little valley of a lateral stream, the herds of cattle, the long rectangular huts of the natives perched on a slope here and there, and looking exactly like Alpine cow-huts, increase the similarity. On a short walk of an hour one morning we picked not less than eighty-eight different kinds of flowering plants, all in blossom; purple and yellow, represented by fifty-three out of the eighty-eight species, were the prevailing tints, and beautiful large irises, gladiolas, and orchids delighted our eye.

And from the last low ridges one gazes to the far horizon east and north across an uninterrupted steppe of pure low grass, over wind-swept Central Ubena.

The scenery of Konde Land I have already attempted to describe, so I will finish up with a picture of the magnificent rain-forest which covers the higher slopes of the volcanic masses north of the lake and of the Livingstone Mountains themselves. Through the wilderness of long narrow valleys, where great foaming mountain streams saw through lava ridges or wind between a multitude of small volcanic cones, through the chilly grass land in their desolate upper reaches, one enters the forest of the Mporoto chain at about 1800 m. above sea-level. On the steeper slopes this mass of verdure pushes broad tongues much farther down, forming walls of emerald and gold which in luxuriance and beauty surpass all forests I have seen elsewhere on the mountains of Tanganyika Territory. On the highest ridges thickets of bamboo become frequently interspersed with tree forest, and on Mount Rungwe the uppermost forest, between 2400 and 2750 m., is an uninterrupted belt of pure bamboo. Its undergrowth is a soft carpet of *Selaginella*, with large slipping cushions of sphagnum moss in the higher parts, and the few surviving trees disappear in the monotony of the bamboo shafts.

Emerging on the north side of the Mporotos from the cool dripping masses of foliage, where at every turn of the swampy path one is prepared to encounter buffalo, there is a delightful and a wonderful view. Over the half-hidden villages of the sturdy Wasafwa peasants, over their fields golden with ripening corn, their pastures dotted with large herds of cattle, sheep, and goats, one gazes into the hazy plain of the upper Ruaha, 1000 m. below, and across to the solid scarp of Usangu. And due north, across the high Ruahu-Rukwa divide, above a foreground of steppe and park-bush, rises the great steep pyramid of Mount Beya to nearly 3000 m., standing high above the corner of the scarp at the meeting-point of the three great rifts. It is of nobler forms even than Rungwe, a sunlit pointed mass of green with just a few furrows on its triangular slopes to give those lines of shadow without which there can be no harmony of light.

Fauna.—We need say only a few words on the fauna, which, taken as a whole, differs but little in its composition from that of the rest of Tanganyika Territory. The most striking feature of the area traversed is the abundance of elephant. Though they disturbed sometimes the peaceful progress of my gangs when cutting survey traverses, we soon saw in them very useful allies when we came to explore the mountain valleys, through the jungle of which marching and surveying would often have been impossible without the frequent elephant tracks. And as an engineer I admired their well-laid-out and well-maintained zig-zag paths up steep slopes and their clever utilization of the smallest topographical advantage when crossing a gorge or avoiding an obstacle. Buffalo, too, abounds in many places, and with the elephant is becoming a serious hindrance to native cultivation. On the Ubena plateau big game is practically non-existent.

As to fly, it is of course risky to make definite statements based on observations during a single march, as so much in their distribution depends on seasonal changes. But it remains a fact that with very few exceptions I have never been seriously annoyed during my seven months' wanderings in the south-western area, and even the few bad days were mild compared to the real fly areas in Central and Northern Tanganyika Territory. At any rate, to the south and west of the Ruhuje I did not see a single specimen of *Glossina*. In the temperate rain forest of the Mporoto Mountains, on the other hand, at altitudes above 2000 m., a tsetse-like fly was common, which Mr. Swynnerton has determined as *Hamatopota* sp. In Ukinga, high up on the Livingstone Mountains, I caught an *Anopheles* mosquito at 2360 m. ! At the same time an epidemic of tick fever was raging throughout the highlands which was a matter of grave concern for the medical officer at Ntukuyu.

A most interesting phenomenon, already described by Elton and Sir Harry Johnston, is the Kungu fly of lake Nyasa, tiny insects belonging to the genera *Cænis* and *Corethratus*. All along the lake pale brown clouds, often of huge dimensions, frequently appear rising from the

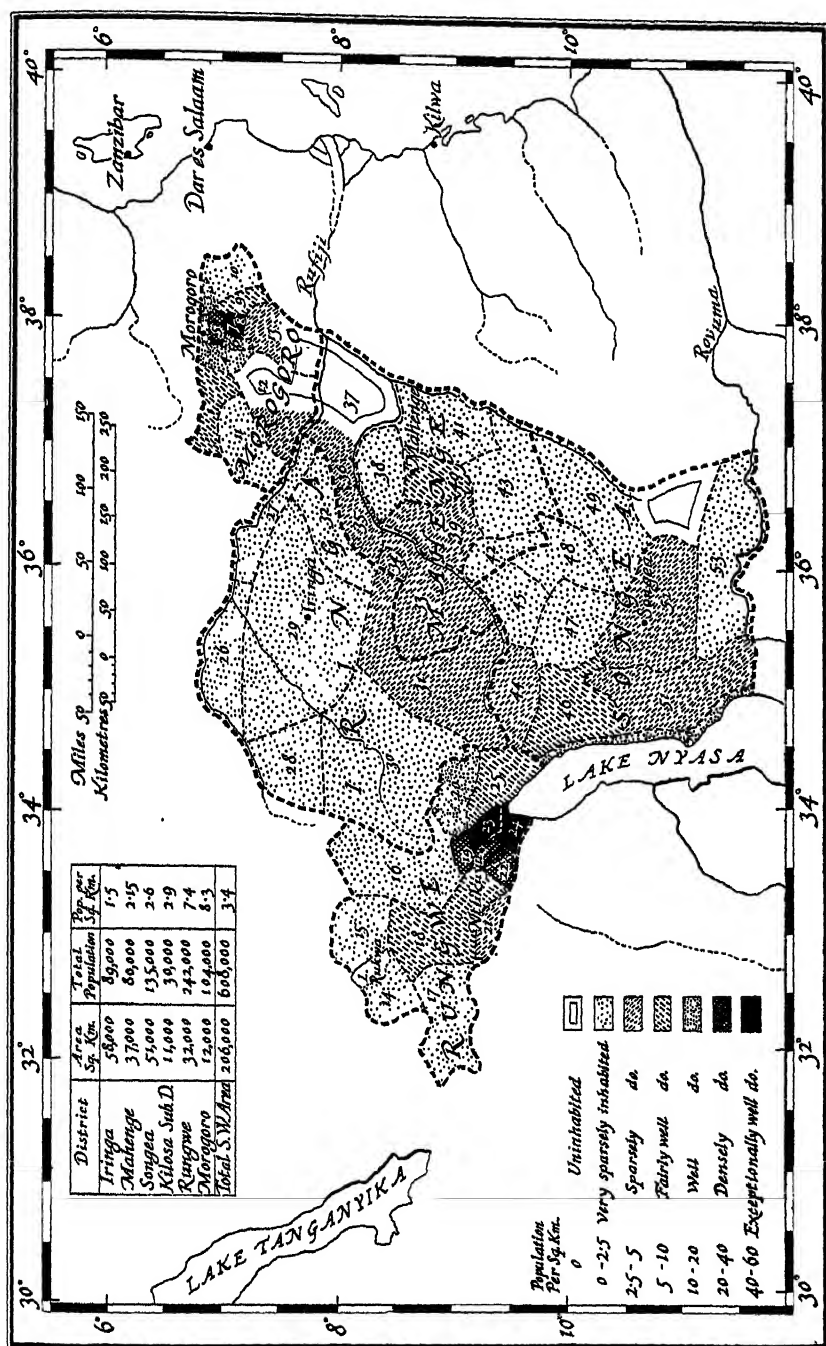
water and drifting with the wind ; from a distance they look just like smoke from a steamer. They consist however of billions of these little insects, which apparently pass their larval stage in the water, whence they rise for their short sexual life of an hour or two, to be blown about and perish on water or land after their life's work has been accomplished in mid-air. A pretty native story attributes this " smoke " to an old hemp-smoker, who, having gone mad through his vice, threw himself into the lake, where he is now condemned to emit smoke clouds throughout eternity.

Population.—In these days when one hears a good deal of the " teeming millions of Africa " and of their potential productivity, it is as well to examine more closely the characteristics of human settlement in East and Central Africa. It is here that the geographer must step in to tell us if and where the realization of our hopes is likely and whether, perhaps, limitations exist to our endeavours ; and to guide us in those directions where progress, based on a thorough grasp of the dominating set of interrelated geographical conditions, may be possible.

The first task is to investigate density of population ; for a country or a district can be more populous than another and yet, owing to its larger size and correspondingly wider scattered population, be far less productive owing to the long distances to be overcome by the collecting agencies such as railways and roads. This is more particularly correct when production, as is the case in East Africa, means primarily agricultural production of bulky and comparatively low-valued goods. The density map* which I am showing is an attempt to give an idea of the

* The numbers in the population map refer to the following subdistricts whose names and population are given in a table on Mr. Gillman's original. It will be noted that there is some discordance between the figures given in the sketch-map for the Kilosa subdistrict and the corresponding figures in this table, but, the author having returned to Tanganyika, it has not been possible to resolve this discordance before publication.

MOROGORO DISTRICT.			19 Upper Konde	41,000	36 Ifakara ..	3,760
<i>Subdistricts.</i>			20 Wawanji ..	25,000	37 Kiberege ..	2,850
1 Kilosa ..	21,950		21 Walambia ..	6,000	38 Luri ..	5,300
2 Morogoro ..	17,700		22 Bandali ..	23,000	39 Kiwanga East	14,800
3 Ngerengere ..	6,600		23 East Konde ..	23,000	40 Central Sultana	14,500
4 Mlali ..	13,600		24 Lower Konde	36,000	nates ..	
5 Kinole ..	9,000		25 Wakinga ..	28,000	41 Eastern Sultana	4,000
6 Mgeta ..	7,700				nates ..	
7 Matombo ..	13,800		IRINGA DISTRICT.		42 Mpepo ..	6,800
8 Mtombozi ..	11,900		<i>Subdistricts.</i>		43 Mponda ..	2,600
9 Mvuha ..	9,600		26 Wagogo ..	3,000	SONGEA DISTRICT.	
10 Kisae ..	4,500		27 Wasagara ..	2,400	<i>Subdistricts.</i>	
11 Kisanga ..	5,550		28 Wakimbu ..	2,700	44 Ubena ..	9,200
12 Kidodi ..	2,700		29 Wahehe ..	13,500	45 Matumbi ..	2,300
13 Kisaki ..	9,700		30 Wasangu ..	24,000	46 Upangwa and	
RUNGWE DISTRICT.			31 Wabena ..	37,600	Ukisi ..	20,000
<i>Subdistricts.</i>			32 Wadzungwa ..	5,400	47 Mapore ..	7,200
14 Wawanda ..	3,500		MAHENGE DISTRICT.		48 Parangu ..	4,500
15 Wawungu ..	3,500		<i>Subdistricts.</i>		49 Wadendeule ..	12,000
16 Wasafwa ..	5,000		33 Kiwanga west	14,630	50 Lake Shore ..	21,500
17 Wanyamwanga	6,000		34 Kihanzi ..	2,680	51 Wamatengo ..	25,000
18 Central Igale	42,000		35 Ruipa ..	7,850	52 Zulu Wangoni	31,200
					53 Warao ..	2,000



Density of Population in South-West Tanganyika Territory

distribution of the population in South-West Tanganyika Territory. It is fully realized that, with none too accurate records at our disposal, such maps can, at present, be merely an approximation to the truth, but as we are here concerned with relative rather than absolute values, and as the sources of error are the same for all administrative districts, the information is sufficiently exact for purposes of comparison. The figures are based almost exclusively on the 1924 tax registers.

Taking the south-western area as a whole, its mean density of 3·4 per square kilometre lags behind the mean density (4·4) for the whole Territory by 25 per cent. And in detail we notice a distinct interdependence between water-supply and population density. The great areas of typical arid or semi-arid steppe, both of the lowlands and on the central plateau, carry less than 2·5 per square kilometre. The better-watered foot of the great scarp and the moister plateau regions of Ubena and Ungoni follow next with 2·5 to 5, while with increasing and increasingly permanent moisture, such as is afforded by the well-watered circum-Nyasa Mountains and the Mahenge and Uluguru outliers, density rapidly rises to 10, 20, and more. Only in very few and small areas where topographical and climatic conditions combine favourably, such as Konde Land, does density reach more than 40 and up to its maximum of 60 per square kilometre.

Next in importance to density itself is the fact that, however small the area over which mean density figures are worked out, these will, except in very rare cases, not represent an even distribution. For in East Africa, where the prevailing physical conditions are those of a semi-arid country, characterized by a wide-meshed network of usually only intermittent rivers and a ground-water supply deep seated and therefore not easily tapped by primitive methods, the oasis type of human settlement is general. Even in districts which, as the footlands of high scarps, are comparatively well provided with permanent streams, this type continues. Only in a few topographically most favoured mountain areas is the drainage net so closely woven that it allows of settlement more nearly approaching to that close type which is the rule in the temperate zones of the Earth or in the great deltaic flats of the tropics and sub-tropics. A point well to remember is that this semi-arid oasis type is not so much due to the lack of "agricultural" water, *i.e.* of water necessary to grow crops, such water being as a rule provided amply and at the right time by the annual rains, but that an oasis is the expression of the need for a perennial, sufficient, and reliable supply of domestic water, without which human settlement becomes impossible. Hence the ever-recurring, sad, and disappointing experience that even in fairly densely populated country narrowly circumscribed areas of settled ground, along a stream or round some water-holes, are invariably separated by wide strips of uninhabited and uncultivated land, which, however suitable soil and climate may be in other respects, cannot be

permanently settled by man owing to the absence of a permanent water-supply.

It seems to me that this very decided and geographically determined limit to an increase of population in East Africa has not, so far, been sufficiently realized. There is, indeed, one conceivable way out of the deadlock, namely, a large-scale tapping of the vast stores of deep-seated ground water and, in suitable localities, as *e.g.* the Kilombero plain, the storage of the masses of water which not only run to waste annually, but by inundating vast tracts add very considerably to the uninhabitable area. Whether the time is ripe for such enterprise, which would of necessity have to be undertaken by the State, is an administrative rather than a geographical question. In the meantime, if we wish to increase production we should look less towards increased population, but towards less wasteful methods of agriculture on the part of the existing population.

However, I do not wish to be misunderstood. For I do not maintain that wide districts of East Africa are to-day carrying their maximum of population. On the contrary, and especially in South-West Tanganyika, the most promising portions of which have not yet recovered from the appalling loss of life due to the 1905-1906 rebellion, there are plentiful signs that the population has once been much larger than at present. For this the early explorers also are witnesses. One may therefore well hope that peaceful administration for a generation or two, and the linking up of their native lands to the world's markets, will lead to an increased population and to the return of the many who are forced to-day to seek employment far away from home.

And now a short glance at the people themselves. Along the northern part of the great scarp we find a fairly thick population on the upper slopes and a string of oases along the very fertile foot. The people are mostly Wawidunda who have adopted a dual life, and by descending and reascending nearly 1000 m. daily for a good part of the year, reap crops in the hills as well as on the plain.

Further south, across the Ruaha, as well as in the eastern part of the Kilombero, we have Wabunga as the main element of the population. Their staple crop is rice. They do not make a very virile or pushing appearance, although they claim Zulu descent. From the edge of the high plateau Wahehe have of late descended some way down the slopes of the scarp, to grow mountain rice and to assist in the destruction of the forest.

Along the central and upper Kilombero and its tributaries sit likewise Wabunga, but of a much-improved type compared with that of their eastern tribesmen. On the fertile riverine land their agricultural achievements are indeed remarkable. They share the ground with the Wandamba, an amphibian people who eke out a precarious existence as fishermen, living on pile dwellings in the semi-inundated areas where they also grow rice.

The Mahenge highland is the home of the Wapogoro, admittedly one of the most backward tribes in East Africa, while opposite on the edge of the Iringa scarp are the widely scattered settlements of the Wadzungwa. These are the remains of a formerly much wider-spread people who have retired into the less accessible mountains before the raiding Wahehe.

Why the broad, wooded, and well-watered expanse of country between the Kilombero plain and the plateau edge, a series of already well-denuded fault steps, is entirely uninhabited, is a problem which still awaits an answer.

The further one penetrates into the Kilombero "Punjab," the more prominent becomes the Wabena element and with it attempts to re-stock the lowlands. Thus it is here that on a westing march one sees cattle for the first time.

On the wide Cretaceous plateau lives a very sparse population who, though they call themselves Wangoni, that is, claim Zulu descent, are in reality the remains of the conquered tribes, and do not appear to have attained to a strikingly high standard. Here it is that nearly everywhere one notices signs of former much more intensive cultivation, dating back to the days of Shabruma, the mighty Zulu chief. Hemp-smoking is to-day a serious vice in these parts.

The genuine Wangoni, round about Songea, on the other hand, are a much more hopeful race, and climate and soil of their well-watered country seem most suitable for greatly increased production. If one can rely on early German estimates, this tribe has dropped from 150,000 before the 1905 rebellion to 31,000 to-day, a deplorable fact, but one which entitles one to hope for a rapid increase under a stable administration.

Likewise most hopeful are the Wamatengo, who live on the highland overlooking Nyasa to the south of the Ruhuhu Depression, a tribe whose fertility is proverbial throughout Tanganyika Territory; and the Wanyasa, the accumulation of small tribes who form the people of the lake-shore and the coastal ranges, are agriculturists, herdsman, fishermen, and artisans—surely many-sided accomplishments.

Upangwa and Ubeni are another great area where the Zulu invasion and the rebellion have left unmistakable signs everywhere, and where there is room and water for a much-increased population. But the outstanding feature, especially in the higher parts, is the, for East Africa, uncommonly large size of the fields tilled by the individual peasant, who apparently requires not only all the skill he can command, but also expanse, to grow his annual wants in the damp and cloudy climate of these wind-swept highlands. In the west there is much cattle, whilst in the cut-up country to the east there is none. Bamboo forms one of the staple crops of these lands, exclusively grown for the sake of its sweet sap, which is tapped during the cold rainy weather when the stalks

shoot rapidly, and transformed into a very excellent though somewhat potent intoxicant.

A marked increase in density takes place immediately the wind-swept Ruhuje-Ruaha Divide is left and the ridges and valleys of the eastern Mbarali drainage entered, where there is hardly a point from which one cannot spot one or several native dwellings. What strikes one first is the very sudden change, within the limited area inhabited by one and the same tribe, of hut-form, the thatched shed-hut of the southern, eastern, and central Wabena being replaced to the north and west of the divide by the mud-covered tembe, the typical dwelling of Uhehe and many of the tribes in the great Rift Valley. In explanation of this change the Wabena told me that the reason for building the shed-huts of the former inhabitants, instead of their national tembe, is solely the unsuitability of the clay south of the divide. This is not only interesting from the ethnographical point of view, but seems to bear out my suggestion of more advanced erosive action in the Mbarali drainage, for it seems quite plausible that in the north-western area advanced transport by erosive action has in places produced a colluvial soil, *i.e.* has led to a mixture of the original soils, more waterproof and thus more suitable for roof construction, than the unmixed eluvial or residual soils found everywhere *in situ* in the Ruhuje drainage area.

Into the lower and middle Mbarali valley Wasangu from the Usangu plain have intruded, so that the population round about Kidugalo Mission station consists of Wabena and Wasangu.

Quite contrary to Thomson, who calls them degenerate, I must state that one of the sturdiest and most intelligent native tribes I have ever come across are undoubtedly the Wakinga, whose scattered villages go up to 2600 m. on the Livingstone Mountains. Surely it requires uncommon perseverance to depend on agriculture against so many odds due to an inclement climate and a most accentuated surface. Even the most incredibly steep slopes carry carefully terraced gardens. These people have readily accepted wheat and European potatoes, both of which, introduced only a generation ago by the German missionaries, form to-day the staple food. On the more protected western slopes wheat is grown down to 1700 m., where it suddenly ceases, giving place to the banana of Konde Land, while in the east 2000 m. seems to be the present lowest limit. Another interesting fact, and one well worth considering for the prospective settler, is the following: As a result of the climatic conditions the corn ripens very unevenly, a drawback which is easily coped with on the small fields of the native peasant by daily picking of the ripe ears, but which will never do for the large fields of the European settler, who must, obviously, be able to rely on quick and simultaneous harvesting of his crop.

Cattle in Ukinga are very healthy, and to my lay mind sheep-running, in Ukinga as well as in Ukena, should be encouraged. In fact, I believe

that in the direction of large-scale wool production lies the future development of this beautiful mountain land and its very hopeful inhabitants.

In Konde Land, and there alone, does one at last see really close surface settlement. The present inhabitants, the Wanyakyusa (the Wakonde having long since been driven south across the Songwe), are a prolific, healthy, and highly intelligent race with a standard of autochthonous civilization surpassing that of all other tribes in Tanganyika Territory. Scrupulous cleanliness of body, hut, and stable; a high social standing of their women, who do not assist in the tilling of the soil; the growing of timber and bamboo for structural purposes; and a markedly advanced architectural art, are some of their more striking accomplishments. Here, if anywhere, is a tribe which can be relied upon to respond to efforts directed towards increasing their prosperity and well-being. The present staple food is the banana, but rice and probably cotton in lower, and ground-nuts in upper, Konde have a good future. And between these two divisions where a broad belt of virgin woodland covers rich volcanic soil, one can visualize quite a number of white settlers who might produce coffee and probably tea. Cattle are plentiful, splendidly cared for, and of good quality.

If we may trust German official estimates of 1904 it would seem that in Konde Land, which not only did not suffer from the 1904 rebellion, but very likely received an influx of population from the more disturbed areas on the high plateau, we have a record of a gratifying increase. For while in 1904 the total population of lower and upper Konde Land is given as 63,000, the 1925 estimate by our District Officer, based on tax registers, is 100,000, *i.e.* an increase in twenty years of over 50 per cent.

The northern slopes of the Mporoto chain and the plains at its foot are inhabited by the Wasafwa. These are great agriculturists, and their large fields, mostly of maize, are astonishing and remind one of the culture steppe of Usukuma and the Mwanza area. They keep very large herds of healthy cattle. However the population, nowhere very dense, soon dwindles, as towards the west and north-east the steppe character of the country becomes more pronounced.

I have endeavoured to give a rough outline sketch of a land full of beauty, full of hopeful possibilities, and above all of a land inhabited by nearly three-quarters of a million souls who at present are doomed to unproductive stagnation owing to their remoteness from the pulse of commerce and industry. I have purposely laid stress on the difficulties of topography, climate, and population, not because I hold them insuperable, but because I believe that facing facts is preferable to mere hopefulness. But once more I must insist on the necessity for much more thorough and detailed regional surveys by fully qualified specialists under the guidance of a geographer. Such surveys alone can show us the right path, can keep us from trespassing against the laws of nature and from erring in our judgment of the human material at our disposal.

And, incidentally, by teaching us the history of one of the oldest bits of its crust, such surveys will shed new and badly needed light on the evolution of the Earth's surface.

NOTE ON THE ALTITUDE OF MOUNT RUNGWE

Probably the first estimate of the height of Rungwe is Kerr-Cross's (*Geogr. Journal*, 1895, p. 116), who calls it "fully 9000 feet."

On 10 October 1896 Bornhardt (*Zur Oberflächengestaltung und Geologie von Deutsch Ost Afrika* (Berlin, 1900), p. 171) determined the height trigonometrically from Rungwe Mission, the altitude of which he had made 1490 m. by boiling-point. He arrives at 3120 m. for Rungwe summit, but there seems to be something wrong with his computation. For, taking his angle of $8^{\circ} 50'$, and the horizontal distance from Trotha's 1913 map on 1/100,000 at 9.5 kms., and allowing 10 m. for refraction, the difference in height between mission and summit would be 1486 and not 1620 m. as given by Bornhardt. And if one reduces the level of Lake Nyasa on which B.'s determination of Rungwe Mission was based, from his assumed figure of 500 m. to 471 (*i.e.* the most recent figure as incorporated on the latest, 1919, sheet of our 1/2 M map, and one which my recent survey fully confirms), Rungwe summit would be 2967 m. On his own map Bornhardt shows v. Elpons' height.

This latter, a German official, observed the boiling-point on 16 August 1898 at 3.15 p.m., making it 90.15° Centigrade with an air temperature of 15.5° C.G. (vide *Deutsches Kolonialblatt*, 1898, p. 794). From this the altitude was computed at 3175 m. This is the figure which has been retained to this day on all maps, and it is also given in Krenkel's *Geologie Afrikas* (p. 269), a book published in 1925.

It seems to me not unlikely that v. Elpons made a mistake of $\frac{1}{2}^{\circ}$ Centigrade when reading his thermometer, a mistake frequently made by laymen not accustomed to the use of instruments. Such a mistake would just about account for the discrepancy of v. Elpons' height, as $\frac{1}{2}^{\circ}$ more than his 90.15° would correspond to approximately 538 mm. of air pressure, *i.e.* would tally well with Goetze's aneroid readings (quoted by Kohlschuetter, p. 222) in September and October 1899, of 537.5, 538.4, and 536.1 mm. respectively, as also with my own boiling-point observation of 537.8 mm.

The retention of Elpons' figure is all the more surprising as Kohlschuetter's very careful work during the East African Pendulum Expedition of 1899 and 1900 has been published as long ago as 1907 (*Ergebnisse der Ost Afrikanischen Pendel Expedition der koenigl. Gesellschaft der Wissenschaften zu Goettingen*, Berlin, 1907). Based on the trigonometrical altitudes of the British-German Boundary Commission between lakes Tanganyika and Nyasa, Kohlschuetter gives the trigonometrically determined height of Rungwe summit as 2977 m., with Nyasa level at 477 m. (pp. 150, 208). This would make 2971 m. with lake level at 471.

Fuelleborn (*Das Deutsche Nyasa und Rovuma Gebiet* (Berlin, 1906), pp. 275-6) adopts Kohlschuetter's preliminary computation of approximately 2950 m.

My own observations were made at 9 a.m. on 3 January 1926. The boiling-point, determined by two Fuess instruments graded in millimetres of air pressure, gave 537.8 mm., with air temperature at 12° C.G., and was checked by a Casella Aneroid (No. 10,499), whose behaviour and corrections were well known after five months' continuous use in the field. The computation was based on Ntukuyu Government station (Boma yard), the altitude of which,

referred to Nyasa lake level of 471, is correctly known to be 1555 m. At Ntukuyu the boiling-point was determined before and after the ascent (at 17 h. on the 1st, and at 9 h. on January 4), and the daily variation curve had been established on December 23, January 1, and February 1 and 9, with variations between 9 h. and 17 h. of -2.9 , -2.7 , -2.7 and -2.6 mm. respectively. The mean between Ntukuyu-Rungwe (1427) and Rungwe-Ntukuyu (1435) works out at 1431, which added to 1555 gives 2986 for Rungwe summit.

A trigonometrical check with a mean angle of $5^{\circ} 57'$, a distance of 13,700 m. (from Trotha's 1/100,000 map) and 13 m. for refraction, gave 2996 m.

One can thus safely assume that the altitude of the Siga Mbili summit of Rungwe lies somewhere between 2970 and 3000 m., *i.e.* it is nearly 200 m. less than that shown on all official maps.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: This evening we are to be instructed about that great territory—the largest, I think, that accrued to any of the belligerents after the war—the territory of Tanganyika, which formerly was German East Africa. Some of those present this evening will remember Major Church speaking about it in connection with the Government Commission, of which he was a member. You will remember that he spoke of the great necessity for more knowledge, and that has been again and again emphasized by his chief, Mr. Ormsby Gore, the Under-Secretary for the Colonies—the need for more knowledge of a country which we have now held under mandate for seven years and which has been little longer than that under our occupation. Well, we are going to hear an instalment of that necessary knowledge; or, at any rate, we are to have an indication of the very considerable instalment of the requisite knowledge which has been put at the disposal of the administrators of the country. It is to be given by Mr. Gillman, who will be remembered as having given us a very interesting paper upon Kilimanjaro four years ago. He has been for some years senior district engineer of the Tanganyika Railways, and in the course of his professional duties, and I fancy to some extent outside his professional duties, he has quartered the country in almost every direction. No one is better aware than he is that single exploration like that is not equal in value to exploration by a trained and organized body of explorers traversing a country methodically. But, as I understand that the loan from the Government of which Major Church spoke to you, although it has not actually been paid, has already been spent in the country, we may hope that more organized exploration will follow. But so far as it has gone Mr. Gillman's exploration seems to me to be of the utmost value, because he is admirably well qualified in many scientific ways to be a pioneer. However, you shall judge for yourselves, and I will ask him now to give his lecture upon South-West Tanganyika Territory.

Mr. Gillman then read the paper printed above, and a discussion followed.

Major-General Sir EDWARD NORTHEY: I think you will appreciate that I could, in spite of the lateness of the hour, talk for a long time, because this particular part of the world happens to include precisely the whole of the country over which I took my troops and which I administered during the last three years of the war. First of all, I would like to congratulate the lecturer, and also the gentleman who apparently prompted him to give this paper, by enunciating that railway engineers, when surveying land for the purpose of finding where a railway may go, do not look at anything else. We can congratulate the lecturer on the fact that he did look at something else, absorbed

it, and reproduced it for us to-night. He commenced and ended his remarks by rubbing into us the importance of such regional surveys being made and properly coordinated. I entirely agree with him. I think that many of us have been open to criticism in not being sufficiently long-sighted in these matters. At the same time, I must put it to you that when a Colonial Governor brings a budget forward, with any sort of opposition, you probably find, if something has to go out because people are clamouring for more money for, say, education or agriculture, that the majority are less interested in survey, and cut the estimate for it down: that possibly accounts for what looks like lack of foresight in this matter in Colonial Governments.

Vividly as the lecturer has described it to you, I think that it would be extraordinarily difficult for anybody to give you an idea of the beauty of that country: it is certainly the most lovely part of Tanganyika Territory. I think probably it would be easy for you to sympathize with me when I tell you that when I went up Lake Nyasa with the Nyasa-Rhodesian troops, that country which you have heard described to-night was in front of me, with the enemy in it, and I had to make roads and get my troops through that country, across those rivers, and over those mountains. Not only is the country as beautiful as he has described it, but I agree with what he has said about the natives. There is only one point on which I join issue with him, to a certain extent. I think he is right to give warning with regard to settlement of any sort in that country. But I think there is ample room for white settlement in that part of the country, and I believe, looking to the future and to the possibilities of the whole of East Africa, that it would be a great thing, from an Empire point of view, to encourage such settlement. I do not know what the ideas of the present administration are. I give you only my own opinion after living three years there. I believe that that part of the world, exactly as has been proved farther north in Kenya, is most suitable, and that it would be in the interests of the country, and the natives, to have the dual system; that is to say, a certain number of well-selected white settlers living on the lands which do not belong to anybody and are unoccupied.

The particular part of the country I have in mind is from Dodoma, down through Iringa, towards Tukuyu and Fife. Though the lecturer has been surveying that country from the point of view of railway development he did not tell us where the railways should go. Having had to make roads through it and study it, my own opinion is that the best way to develop that country—and there are enormous possibilities, for you can grow anything at the different altitudes and in the different soils—would be to bring a railway down from Dodoma, through Iringa, to Tukuyu and thence on to Fife. With regard to the Kilombero basin, I believe from what I saw that an enormous quantity of rice could be grown there, as it has been in the past.

I should like to corroborate another remark the lecturer made: that is, that eastwards from Njombe to Lupembe, south of Iringa, it is extraordinary to see the wonderful richness of the country. For miles there are nothing but places in which there have been old native gardens, all now deserted. James Sutherland, the elephant hunter, who was on my staff during the war, fought with the Germans in the great rebellion. He told me that 80,000 natives were wiped out in this particular neighbourhood.

The lecturer spoke of the rainfall in Mporoto Mountains. The rainfall is sufficient, the altitude and, I think, the soil of the right sort to grow tea; and everywhere at about 6000 feet it would be possible to grow good coffee. I believe if in the future that part of the world is properly developed, and the

communications, as I think they will be shortly, taken in hand, it has enormous possibilities. I think that there should be a British white population, and there need not be much fear, if we carry on on those lines, of the mandate ever being anything but British, as it should remain.

Sir WILLIAM GOWERS (Governor of Uganda): I feel signally ill qualified to speak after Sir Edward Northey, for to him we owe it that we now hold that part of the country shown on the map, which I have been particularly pleased to see, and which was dealt with in the very interesting paper we have heard to-night.

One of the things that impressed me was the very keen appreciation that Mr. Gillman has of the scenery of Africa, especially the wonderful scenery of the Rift Valley of East Africa. I think he feels, as I feel, that one of the principal things that enables one to go on living contentedly for many years in tropical Africa is an appreciation of its scenery. I do not know whether he feels as I do, but others have agreed with me, that what appeals most in Africa is some piece of scenery which reminds us of England, or Scotland, or Ireland. Conversely, when in those countries I often say, "That is just like a bit of Africa," and like it the better for that reason.

Unfortunately, I am as yet entirely ignorant of the part of the country that has been described. I belong to a neighbouring and, I hope, friendly State. In any case, although the country I represent and the country with which we are closely allied, Kenya, did have a little friendly argument about the development of the country in the north of Tanganyika Territory, it has none about the development of the country in the south-west. If you have ever read the possibly very tedious proceedings at a certain conference of Governors held in Nairobi last year you will see we all agreed that a railway should be built from Dar es Salaam to the south-western highlands of Tanganyika.

The country described to-night has, of course, also historical importance as great—I will not say greater—than Nairobi, in that the first unofficial conference was held at Tukuyu by the representatives of European settlement in the East African territories. I think that Tukuyu may become as famous in future African history as perhaps Runnymede.

There is one point that I should like to raise in order to elicit some information. I should like very much to know what is the height at which the tsetse fly and Anopheles mosquito respectively are found. I read in the paper that Mr. Gillman had seen the Anopheles mosquito at something like 7500 feet. Personally I have seen tsetse fly at something over 4000 feet—never any higher. I have seen Anopheles mosquitoes at about 6000 feet, but I am not certain I have seen them any higher.

One other word. Would it not be a little kinder to some of us who are not eminent mathematicians if we could be spoken to, especially as regards figures of density of population, in square miles rather than in the metric system? In conclusion, I express my great gratitude for the particularly interesting and informative paper that we have heard, and I hope one day I shall be able to visit the wonderful scenery which Mr. Gillman has described, possibly by means of the railway the location for which he has been prospecting.

Sir HALFORD MACKINDER: If the Governor of Uganda was a little timid of speaking of this territory, which is neighbour to his small kingdom, how much more ought I to be so, in view of the fact that my experience is removed not merely by a considerable distance of miles from Tanganyika, but now also by a considerable distance of years! The problems which it is my

duty to consider to-day concern the Empire as a whole, and it occurs to me to suggest to you that this particular region has become, as the result of the war, one of the vitally important spots in the structure of the British Empire, for the British Empire to-day has a structure. It does not consist merely of a number of territories scattered over the globe. There is a northern belt: Great Britain, Ireland, Newfoundland, and Canada. There was a time when the Romans doubted whether Scotland was habitable for decently civilized people. It is not very long since it was doubted whether any large portions of Canada beyond the St. Lawrence Valley were suitable for white civilization. There, then, is one great zone. The other main belt of the British Empire lies round the Indian Ocean. It starts from the Cape and goes to the Canal, with territories in various degrees of *liaison* with the British Empire; it extends across Northern Arabia and through the Persian Gulf; it is continued in the vast Empire of India; then comes that very wealthy patch on the world map, not in fact so very small, of British Malaya; finally you have the island continent of Australia. So we see a vast arch, spanning the Indian Ocean, with India as the keystone. We have returned to-day to the position that the British Fleet is principally stationed in the Mediterranean. Why? In order that it may go through the Straits of Gibraltar on the one side, if wanted, into the North Atlantic; and in order that it may go through the Suez Canal, if wanted, into the Indian Ocean.

But, as the result of the war, the vastest of all these great territories is that which starts at the Cape, goes continuously up all the east side of Africa, and crosses through the root of Arabia right up to the borders of Persia. Canada is 3000 miles across; Australia is a little less; India is some 1500 miles long, but South and East Africa and Arabia are 6000 miles long. In that region are the Cape and the Canal. The neighbourhood of the Canal is the Charing Cross not only of the shipping world but also of the air world which is coming. Do you realize what will probably be the airship track to Australia? Quite likely through the Mediterranean and down the Red Sea; then across the eastern horn of Africa and down the east coast to Durban; and then on the west winds right across the Southern Ocean to Australia. The return flight would be rather farther to the north, across the Indian Ocean to the east coast of Africa, perhaps to Mombasa, and thence northward and up the Red Sea.

Now consider East Africa from another point of view. There are two parts of the world where there is high ground under the Equator, where white men can settle and link together the white worlds of the north and the south. The one is in South America; the other is in Africa. It is of vast importance, if it be possible, to settle a series of white communities, in relation to the surrounding native populations—they can only be aristocracies, but complete white communities, men, women and children—on this chain of uplands from Kenya, through Tanganyika, into Northern Rhodesia. They will uphold a standard for the civilization slowly growing in the districts around, and will secure British communications in this all-important region. Although it may not be full of wealth, not wealthy like the plains of Argentina, not perhaps with the wealth of the Rand of South Africa, yet none the less it is a region full of beautiful scenery and, in well-chosen areas, with the climate and soil that are needed. There is probably room for a chain of small but very important white communities. I venture to say, therefore, that the close exploration and survey of this region, and the work that is being done in it by such tropical seats of investigation as the Amani Institute, are very significant.

That things are taking place is evident. One hundred pounds' worth of butter from Kenya was put upon the London market during the past summer!

I do not hold out the idea that you are going to see many millions—a new Australia, a new Canada—in that region; but you may see what I venture to call a row of white aristocracies amid the native populations of Africa, extending northward from the Union of South Africa, across the Equator, linking up with the Nile, and by sea traffic, railway traffic, and air traffic with Egypt and Palestine, the focus of the communications of this extraordinary and unparalleled Empire.

Major G. ORDE-BROWNE: There is one brief point that I should like to make in regard to the lecturer's remarks, and that is the extreme importance of the population map he showed. If we are to have a chain of white aristocracies, these aristocracies will require servants and labour, and it is a very serious problem where that labour is coming from. Mr. Gillman referred to the value of the natives in that part, particularly the Wanyakyusa, and I have no doubt that he is perfectly justified in his description of them. Nevertheless, the fact remains that when those same Wanyakyusa leave their own country and go to work on the Central Railways, as they do in small numbers, they are universally regarded as almost the worst labourers in Tanganyika owing to the extent to which they go sick and to what is usually described as their lethargy. Personally, I think it is due to change of climate and food. I only refer to it as illustration of the difficulties we are going to have over labour questions. There is also the question of spirillum fever. Mr. Gillman referred to the prevalence of ticks, and I am sure he will bear me out when I say they are a perfect curse over a large part of that country. We shall undoubtedly have imported labour in view of the sparseness of the population there. Anybody who has dealt with African labour knows how liable natives are to panic, especially in cases of sickness, and I am sure there is risk that we shall find that this imported labour suffers from a variety of sickness, and that if the natives get panic-stricken the area will get a bad name and we shall be faced with real labour difficulties.

There is also the question of the extraordinary roughness of the country as shown by the very striking photographs we have seen this evening, which in itself will, I suppose, although I do not speak with any technical knowledge, introduce great difficulties in the matter of real reconnaissance and development. I would venture to plead for a continual parallel development in the direction of medical research and cognate matters when we are thinking of any questions of regional survey. Unless we have some idea of the difficulties arising from disease or other sources that we are likely to meet, we run a very definite risk by advocating development which may meet with unforeseen disaster.

Mr. C. GILLMAN, in replying, said: I realize it is somewhat late, but a number of points have been raised. May I take Major Orde-Browne first? The question of medical research is rather close to my heart, and I have always regarded it as an essential part of any regional survey. As to European settlement, I consider it my duty before a geographical audience to point out what I perceive to be the difficulty, and, chief of all, that between the wonderful area of white settlement in Kenya and this new area. There are great difficulties on account of topography and climate, and, far from trying to advise against settling in that part, I was only attempting to point out that we require more accurate and intimate surveys from every point of view before we can advise an "aristocracy" to go out there and risk their family, their money, and

everything else. Sir Halford Mackinder rightly mentioned women and children. For what we want is settlers; that is to say, people who will go there and consider the country their own. But in order to do that they must live and be able to rear and bring up children. We want the doctors to tell us whether that is possible. I think we ought to take every opportunity of mentioning this and trying to induce the powers that be to help us to find out what is right and what is wanted. But we all hope that the medical officers and discoverers will say eventually, "Send out your aristocratic settlers into those lands." I think we who have been there and seen the tremendous difficulties ought to refer to them in public whenever we get a chance.

As to the railways. I have deliberately refrained from saying anything in regard to the railways, first of all, because I happen to be on furlough, and secondly, because the question of railway policy out there is by no means settled, and I am not very well able to say what I think. Therefore I hope you will forgive me if I do not reply to General Northey. All I tried to do was to give you, as geographers, what those interested in geography look for—a description of the topography and the economic features of the country; and I thought that thereby you would be able to form your own opinion on the advisability of the one line or the other. That is why I left out railways entirely.

As to tsetse and Anopheles, you will find some additional notes in my paper which I had not time to read, and I fully endorse Sir William Gowers' remarks on the advisability of ascertaining to what altitudes these little beasts really go. As to millimetres and square miles, as the President told you, I am working for the Tanganyika Railways, and as we have taken over those railways which were largely built by the Germans, we had to take over their mileage, which was in kilometres, their whole system being metric. Besides, the latest sheets of the General Staff 1/2 Million Map of Africa now also show contours and heights in metres. General Northey referred to the roads which he built in the days of the war, and I should like to express my thanks for those very excellent roads which are still in existence, and which have helped me and my caravan very considerably in our efforts to survey as much as possible of the country.

The PRESIDENT: We have had an exceptionally interesting evening, and I think our gratitude is due not only to the protagonist but also to those who followed him. It has been very interesting to hear such a discussion opened by the original conqueror of the country and ended by Major Orde-Browne, who has to deal with its future. As everybody knows, the labour problem throughout this newly acquired territory and also our own colony is the most difficult which South Africa has to face. But our gratitude is due, in chief, to Mr. Gillman, and I hope you will follow his advice and read his paper carefully when it appears in the *Journal*, for he left out a very great deal of it. In particular, he left out most of that science in which he is peculiarly competent—the science of geology. I suppose he thought you might easily have too much of "faults" and "strikes," even if the latter are not of the type with which we have become too familiar recently! Therefore he left out a great deal of what is essential to the understanding of the geography of the country. When you come to read the paper you will see how very large an instalment has been contributed to that knowledge, which we all know to be so essential, of this newly acquired territory, and I hope you will signify your gratitude to Mr. Gillman.

ANCIENT SURVEYING INSTRUMENTS

Col. Sir Henry Lyons, F.R.S., Director of the Science Museum

Read at the Afternoon Meeting of the Society, 13 December 1926.

AT the Science Museum in South Kensington it is the practice to illustrate the early stages of any science or industry which dates from ancient times by a few examples selected from such instruments or apparatus as were in use by early civilizations, and in doing this the Museum has acquired examples or copies of some which may be of interest to surveyors and geographers.

The instruments which were necessary for measuring land in the early stages of man's civilization were certainly of the simplest type: a unit of length derived from a part of the human body, such as the forearm or the foot, determined the length of the rod or cord with which pieces of land could be measured, and for a long time these would be of no great size. They would belong to agricultural communities settled in fertile areas, such as the alluvial plain of a great river valley where the need of measurement to delimit and to locate the holdings would be soonest felt. The valleys of the Nile and the Euphrates were the scenes of the earliest civilizations, and their level plains were eminently suited to the simple technique of land measurement which developed there. It is not surprising that but few of these simple instruments have survived, for they were easily prepared and replaced when worn out or lost, and so were of little value.

In Egypt we find records of measurement from very early times, for on the Palermo Stone, which is now in the Museum at Palermo and bears a record of the royal annals of the Old Kingdom, river gauge readings occur and "numbering of gold and lands" is recorded as taking place in the reign of an unknown king of the II. Dynasty (*circa* 3000 B.C.).

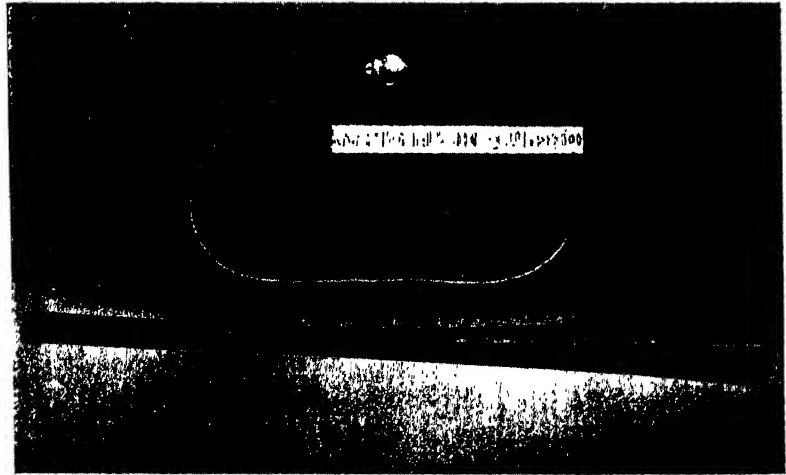
Such a "numbering" of the royal possessions made every two years throughout the land by the officials of the Treasury, would be a sort of verificatory survey of State property which doubtless included herds as well as land, and this biennial census was so regular a procedure of the administration in these early times that events in the reign of the king were dated with reference to it.

A little later we meet with evidence of the registration of property, for about 3000 B.C. the property of a high official, Methen,* who lived under the third dynasty, was recorded on the walls of his tomb at Saqqara, where it is stated to have been duly registered as belonging to him in the royal archives or registry. At this time therefore there must have been a well-developed method of measuring the land and of computing the area of properties, while the registration of land and its measurement

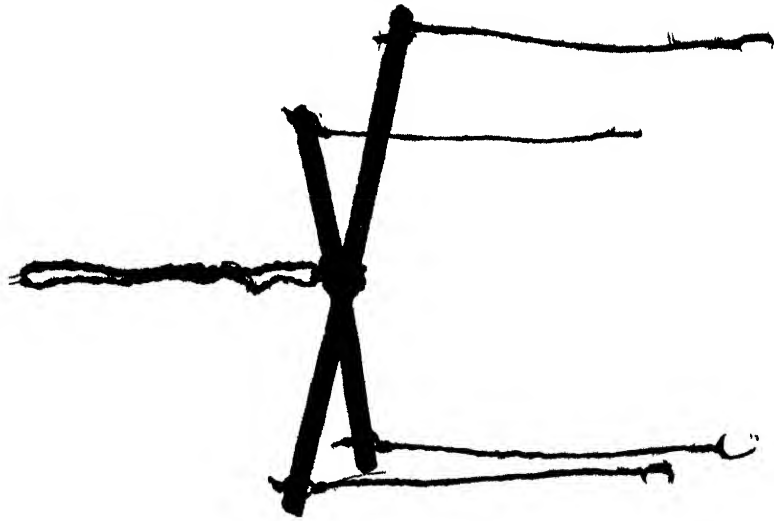
* Breasted, 'Ancient Records' (Chicago), pp. 171-5.



Land-Measurers at work, from wall-painting in tomb of Menna at Sheikh Abd el Qurna, Thebes



The Merkhet of Ancient Egypt



Groma from the Fayum : suspension and weights restored

was becoming highly organized, as being essential in a country where all payments of taxes were made in kind and rent was paid in the same way.

Another tomb at Saqqara, that of a certain Mes,* furnishes us with information of exceptional interest. Certain lands near Memphis, which the Pharaoh Amosis (1580 B.C.) had conferred on an ancestor of Mes named Neshi, were, during the minority of Mes, claimed by a certain Khay as his property. A lawsuit followed in which Khay produced false title-deeds, whereupon Nubnofret, the mother of Mes, appealed to the official registers, saying, "Let there be brought to me the registers from the Treasury and likewise from the Department of the Granary of Pharaoh." A commission was sent by the court to make extracts from the registers, but by means of falsified copies Khay gained his case; he was, however, non-suited on appeal when the evidence of many neighbouring landowners was taken.

No map of landed property in ancient Egypt has come down to us, but on the tomb walls we meet with representations of land-measurers at work, and their methods are shown on the walls of the tomb of one Menna † at Thebes, a land overseer and inspector of the boundary stones of Amon. The tomb, which is situated in that portion of the Theban burial-ground known as Sheikh Abd el Qurna, was cleared out by Mr. R. Mond a few years ago. The scene depicted shows two chainmen measuring a field of corn with a long cord on which are knots or marks at intervals which seem to be about 4 or 5 cubits in length; each also carries a spare cord coiled up on his arm. Beside them walk three officials, who carry writing-materials and who are accompanied by a small boy carrying writing-materials and a bag in which are probably documents and plans referring to the property. An old man and two boys also accompany the surveyors, and a peasant brings a loaf of bread and a bunch of green corn.

A similar scene is pictured on the walls of a tomb belonging to a certain Amenhotep, also at Sheikh Abd el Qurna, where it is possible to see that the cord terminated in a ram's head. This is also shown on the statue of the priest Pa-en-hor from Abydos, which is now in the Cairo Museum; he is represented in a kneeling position and is holding a rolled-up measuring-cord, at each end of which is a ram's head, showing that he was an official of the temple of Amon-Ra.

The rich harvest of papyri dating from Ptolemaic and Roman times which have been recovered from ancient sites in the Fayum and elsewhere in Egypt in recent years furnishes much valuable and interesting information concerning the measurement of land, its registration, its quality, and many other matters of a similar character.

A particularly complete collection of official papers from the bureau of Menchis, the komogrammateus, or government scribe, of Kerkeosiris,

* Loret, 'Zeitschrift für Ägyptische Sprache,' 39 (1901). Moret, *ibid.*

† Borchardt, 'Zeitschrift für Ägyptische Sprache' (1905), p. 70.

close to Tebtunis, was found in 1899-1900 by Professor Grenfell and Dr. Hunt when they were excavating the site known as Um el Baragat, the ancient Tebtunis, on the south side of Gharaq in the Fayum, and was published by them in 1902. The papyri date from about 120-111 B.C., and deal largely with land measurement, land registration, and kindred subjects.

The village of Kerkeosiris, to which many of them refer, contained 4700 arouræ, or about 3100 acres of land, which in the fifty-second year of Ptolemy Euergetes II. (119-118 B.C.) were distributed in seven different categories. Another papyrus from Tebtunis gives a detailed description of certain small plots of land on the east side of Crocodilopolis Arsinoë (Medinet el Fayum), between the road round the town and a large canal. The dimensions are given in schoënia, and the plots are of the usual small size; some belong to private individuals, one belongs to the queen, another is recorded as common land, while a public road between the private property and a public canal is separately registered. The same conditions may be exactly paralleled round Medinet al Fayum to-day.

From early times the marking out of the province boundaries was recognized as being of great importance, and the inscribed stelæ which were placed on the limestone cliffs on either side of the valley in order to define them in a permanent manner, have in some cases been preserved until the present time. In the eighteenth dynasty King Ikhnaton set up such stelæ on both sides of the Nile Valley in order to delimit the district of his new capital, and the position of fourteen of them are known with more or less accuracy to-day, eleven being on the east side of the river and three on the west. In the inscription the length of the district is defined as follows: "from the southern mark as far as the north mark measured between mark and mark on the east mountain of Akhetaton (the town) amounting to 6 iter $\frac{1}{2}$ and $\frac{1}{4}$ of a khet and 4 cubits. Likewise from the south-west mark of Akhenaton to the north-west mark on the west mountain of Akhenaton amounting to 6 iter $\frac{1}{2}$ and $\frac{1}{4}$ of a khet and 4 cubits; and the area within these four marks, from the east mountain to the west mountain of Akhenaton . . . opposite, it belongs to my father Aton. . . ." * From the boundary marks which still remain it is possible to form some idea of what the Egyptians could accomplish in the measurement of long distances in the fourteenth century B.C.

In 1909 Mr. C. F. Montagu of the Survey of Egypt † connected the northern and southern boundary marks on both sides of the Nile Valley with the Survey triangulation. The distance between the north and south marks on the eastern hills was found to be 15,075 metres, while that between the corresponding marks on the western hills was 15,021 metres. In the latter case the southern mark has now disappeared, and there is

* Breasted, 'Ancient Records' (Chicago, 1906), 3, p. 398.

† Montagu, *Cairo Scientific Journal*, 1909, p. 80.

some uncertainty as to its original position and therefore about the length, but it is clear that they were able to lay out and measure distances of this size with a very creditable accuracy. They undertook the task of laying out two lines of equal length about 15 kilometres in length and from 20 to 25 kilometres apart on the intersected margin of the limestone plateau on either side of the Nile Valley, and carried it out with a very considerable measure of success. So far as we know, they had only their measuring cords and rods and the merkhet or plumb-line to aid them.

In the case of buildings a higher accuracy could of course be attained though the methods and instruments employed were doubtless the same as in the field, namely the cord and the rod. As an example of the accuracy to which the Egyptians attained early in the third millennium B.C. we may take the Pyramid of Khufu (Cheops) near Giza, which has been recently remeasured by the Survey of Egypt.* The length of the four sides were found to be :

North side	..	..	..	..	230°253 metres
South side	..	..	..	..	230°454 "
East side	..	..	..	..	230°391 "
West side	..	..	..	..	230°357 "

The mean value of the sides is therefore from north to south 230°374 metres, and from east to west 230°354 metres; and as the length of a side of the pyramid was 440 royal cubits, the length of the cubit derived from these measurements is 0·5236 metre and 0·5235 metre. This indicates great care in the use of the cubit measures which they had at that period.

The orientation of the axis of the pyramid may be derived from the azimuths of the sides, which were found to be :

<i>Mean.</i>					
North side	..	..	..	89° 57' 32"	} 89° 57' 48"
South side	..	..	..	89° 58' 03"	
East side	..	..	..	359° 54' 30"	} 359° 56' 00"
West side	..	..	..	359° 57' 30"	

Taking the general mean as representing the azimuth of the axis, it is only 3' 06" to the west of true north; and this result was doubtless obtained with the aid of the "merkhet" or plumb-line used in connection with circumpolar stars.

This instrument was in use in Egypt from very early times, and consisted of a short plumb-line and plummet hanging from a holder (*ἀρολόγιον*), and this was aligned on any object by looking through a cleft piece of the centre-rib of a palm leaf (*φοίνιξ ἀστρολογίας*) as a sight vane. It was used for setting out a line in any selected direction with the aid of terrestrial marks or a celestial body such as the sun or a

* 'Determination of the Size and Orientation of the Great Pyramid of Giza,' by J. H. Cole. Survey of Egypt, Paper No 39. Cairo, 1925.

star. It is often referred to as being employed in the ceremony of the "Stretching of the Measuring Cord" or the laying out of the axis line of a temple at its foundation. This procedure is referred to in the inscription on the Palermo Stone which has already been mentioned, and doubtless it was a survival from very early times when the primitive shrines were actually set out on a bearing so determined.

Subdivisions of right angles do not seem to have been in use, and there is no satisfactory evidence that the rule of Pythagoras for laying out a right angle was in use before Greek times. The peasantry in Upper Egypt now employ a simple and primitive method for laying out a line perpendicular to another which may preserve an ancient practice: the ends of a rope are attached to two pickets placed at equal distances on either side of the point from which the line is to be laid out, and the centre point of the cord when stretched out gives a point on the line required.

Not only were the Egyptians of these early times competent to measure lands and lay out large buildings, but they had attained a very satisfactory accuracy in levelling, and of this the Great Pyramid at Giza furnishes proof. The rock pavement on which the pyramid was built was carefully levelled before the construction of the pyramid was begun, and levelling which has recently been carried out by the Survey of Egypt* shows that it was very successfully done. The pavement surface was found to have a slope of only 6 mm. from east to west, and of 14 mm. from south to north over a distance of 230 metres in each case, or 1 in 38,000 and 1 in 16,500 approximately. Sir William Flinders Petrie, F.R.S., in his work at the pyramid of Meidum, south of Cairo, found levelling lines marked out at cubit intervals on wing walls built at the angles of a construction in order to provide the masons with a control for their work; so that it was evidently the regular practice.

Dr. L. Borchardt, in his paper on "Nilmesser und Nilstandsmarken," adduces many facts in support of the view that the surveyors of ancient Egypt carried out a line of levelling from the head of the Delta to the First Cataract in connection with the nilometers which were built at every important town; and this too was done with a very fair accuracy, since the average slope deduced from the scales on these nilometers works out at 1 in 14,440 as compared with 1 in 13,700, as given by the levels of the Irrigation Service. The instrument used may well have been the right-angled isosceles triangle of wood, with a plumb-line attached to the apex such as the masons used; it would have been placed on a long wooden straight-edge, which in its turn rested on pickets. In this way, levelling of a very fair accuracy could be rapidly executed.

Thus we see that land-surveying was regularly practised at all periods in Ancient Egypt, although the instruments in use were of the simplest kind, namely, the measuring cord of 100 cubits (52·5 metres) and the

* 'Determination of the Size and Orientation of the Great Pyramid of Giza,' by J. H. Cole. Survey of Egypt, Paper No. 39. Cairo, 1925.

measuring rod, together with the "merkhet" for laying out lines in any desired direction.

In the valley of the Euphrates also land measurement was carried on from earliest times, though descriptions of procedure and of the instruments used are few. A tablet from Tello, which is now in the Museum at Constantinople, bears a dimensioned plan of a royal property of which the area was 208 hectares, or about 515 acres. The fields were measured with a cord just as in Egypt, and the land-measurer is referred to in the land charters known as "Boundary Stores" as the "dragger of the rope." Such a measuring line or rope, as well as a measuring rod, which was also in use, is shown in a picture of the moon-god.*

It was not until Græco-Roman times that we meet with another surveying instrument—the groma. It was widely employed in Italy, where the Romans attributed the first use of it to the Etruscans, but it was also in use in Egypt, and it seems possible that Egypt may after all have been its place of origin. Though more than one form of it is known, the groma consists essentially of two pairs of plumb-lines suspended from the ends of two rods which were set at right angles to one another. Such a pair of plumb-lines with the wooden rod which carries them at its extremities is in fact a double "merkhet," and it is not impossible that this development was due to some Greek engineer who, being familiar with the use of the merkhet in Egypt, realized the advantages of an instrument with which alignments could be laid out and lines set out at right angles to one another.

The instrument is represented on the tombstone of a certain Æbutius Faustus Mensor, which was found at Ivrea near Turin,† and on it the central pillar and the crossed arms from which the plumb-lines were suspended are shown. The metal portions of another were found in Bavaria, but the form there seems to have been different.‡ In this case the central pillar supported a square wooden frame, and the plumb-lines hung from the centre points of the four sides. Frontinus describes one in which a movable plate is pivoted on a stand, and the plumb-lines are suspended from the ends of two diameters taken at right angles to each other.

In 1912 Dr. M. Della Corte ‡ found in one of the houses of the Via Abbondanza at Pompeii the metal parts of a groma which were sufficiently well preserved for him to reproduce the design of original instrument as used by the gromatici of that period, 79 A.D. A full-sized example based on Dr. Della Corte's plan is now in the Science Museum at South Kensington.

The instrument consists of three parts: (1) the iron shoe or point which was driven into the ground (ferramentum); (2) the column and

* *Antiquaries' Journal*, vol. 5, pl. xlviii.

† *Jahrb. d. Deutsch. Archæol. Inst.* 1901.

‡ *Monumenti Antichi Accademia dei Lincei Rome*, vol. 28.

the projecting arm (rostrum), which enabled the surveyor to bring the centre of the cross vertically above the centre of the boundary-stone beside which the groma had been placed; (3) the cross (stella) formed of two rods fixed at right angles to each other, and from the extremities of which plumb-lines were suspended. When one pair of these was aligned along a line or boundary which had been previously determined, other lines at right angles to it could then be laid out by means of the other pair of plumb-lines. With this instrument the Roman surveyors laid out the plans of their cities and camps, as well as the main roads of the country. It was with it that the agricultural holdings were delimited, since these were all parallel to the roads and paths which divided them, starting with the *Cardo maximus* which ran from north to south, and the *Decumanus Maximus* which ran from east to west.

The use of the groma for laying out agricultural holdings is referred to by Hyginus (first century A.D.), who describes the normal arrangement of field plots along the roads and pathways in cultivated land, their shape being always rectangular, and their sides parallel to the roads, which were arranged so as to intersect at right angles.*

Recently a roughly made instrument of this type, which was to be held in the hand instead of being mounted on a stand, has come to light. It consists of two pieces of palm-leaf rib 352 mm. and 342 mm. long respectively, which are tied together at right angles with a piece of palm fibre cord. The upper rod has a part of the rounded "keel" of the palm rib cut away so as to form a stop against which the lower rod rests when it is in the correct position. The plumb-lines and plummets were missing, but the upper part of each rod is deeply notched at 12 to 15 mm. from its ends for the attachment of the plumb-lines. The instrument was evidently made by some landowner or cultivator for his own needs. The precise locality in which it was found is not known, but it was with a quantity of material which was brought back by Dr. Grenfell and Dr. Hunt of the Egypt Exploration Society who went to the Fayum to collect papyri of Græco-Roman age in 1899. No mention of the groma has been found in any of the Græco-Roman papyri, but it is now certain that the instrument was in use in Egypt in those times.

In this work the Roman surveyor used also the 10-foot rod, the *decempeda*, or *pertica*, for measuring the various lengths and distances as required. Recently at Enns, in Northern Austria, the ancient Lauricum, there have been found two examples of the bronze terminal piece (*capitulum*) of such a rod.† Each end-piece is 8.5 cm. long, is slightly tapered, and ends in a flat circular disc which was brought into contact with the disc on the next rod when a distance was being measured. These end-pieces also bear the marks of the subdivisions of the unit of length which

* Cf. Oxé, *Bonner Jahrbuch*, vol. 128, pp. 20 ff.

† Dr. E. Nowotny, "Römische Forschung in Oesterreich, 1912-1924," *Archäol. Institute, Vienna*, 1925.

was used, and it proves to be the "pes Drusianus" of 333 mm. or 335 mm., inches of this foot being engraved on the capitulum. There are also subdivisions of another unit, semuncia (12.45 mm.) of the "pes monetalis." Another example of an end piece of a smaller type was also found at Enns on which inches of the "pes Drusianus" and digiti of the "pes monetalis" were engraved.

So far all surveying instruments have been of the simplest character, but by Hero of Alexandria a great advance was made. He fully appreciated the limitations of the groma and the inconvenience experienced when it was used in the field. He therefore set to work to design an improved instrument of wider application. The result was the dioptra, which he describes minutely in his work which has come down to us. Unfortunately the eleventh-century codex which is preserved in the Bibliothèque National at Paris is incomplete at some part of the description, so that a reconstruction of the instrument is not easy. Professor Herman Schöne* has published a reconstruction, but an attempt by Mr. E. Lancaster Jones of the Science Museum to prepare working drawings from which a copy of the instrument could be made has shown that there are many points which are still in doubt and which need further study. With the dioptra, not only could lines be laid out in any direction, and vertical angles measured, but levelling could be carried out.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: We are to listen this afternoon to Sir Henry Lyons, the Director of the Science Museum, on a very interesting subject, "Ancient Surveying Instruments." There are few who could deal with it as Sir Henry Lyons can. He combines more different sciences than almost anybody I know. When I first knew him he was Director of the Survey in Egypt and the only member of the Egyptian Government in a high official position who both knew and cared about Egyptology—but that may be a libel on several members of the Government, particularly on Lord Cromer himself! Sir Henry is able to deal with this science both from the point of view of archæology and Egyptology, and I think it will be most interesting to hear him.

Sir Henry Lyons then read the paper printed above, and a discussion followed.

Colonel E. M. JACK (Director-General, Ordnance Survey): I have listened with great pleasure to Sir Henry Lyons' most interesting paper. I think we must admire the accuracy of the results attained by the earlier surveyors in spite of the very primitive instruments they had. The only thing that occurs to me to say is what amounts to nothing more than a confession of ignorance. In the Library at the Ordnance Survey there is a Latin inscription put up by my predecessor to the effect that it is the Library of the Ordnance Survey of the British Islands, and in that inscription the word *gromaticus* appears. I did not know that word when I learnt Latin, and I have always wondered where it came from, but after hearing Sir Henry Lyons' paper I feel I know.

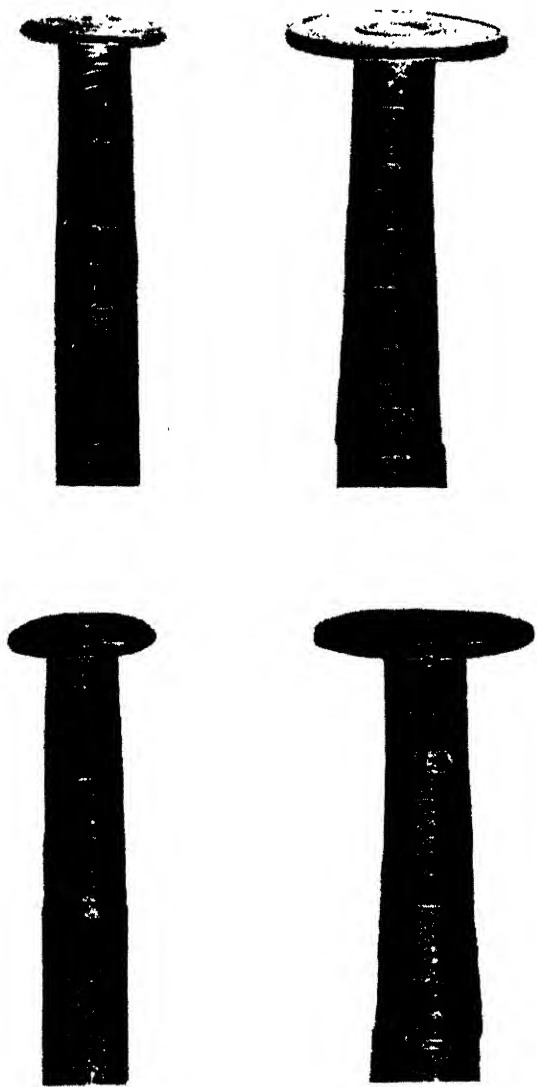
Mr. LANCASTER JONES (Science Museum): When we first commenced

* *Jahrb. d. Deutsch. Archæol. Instituts*, 1901.

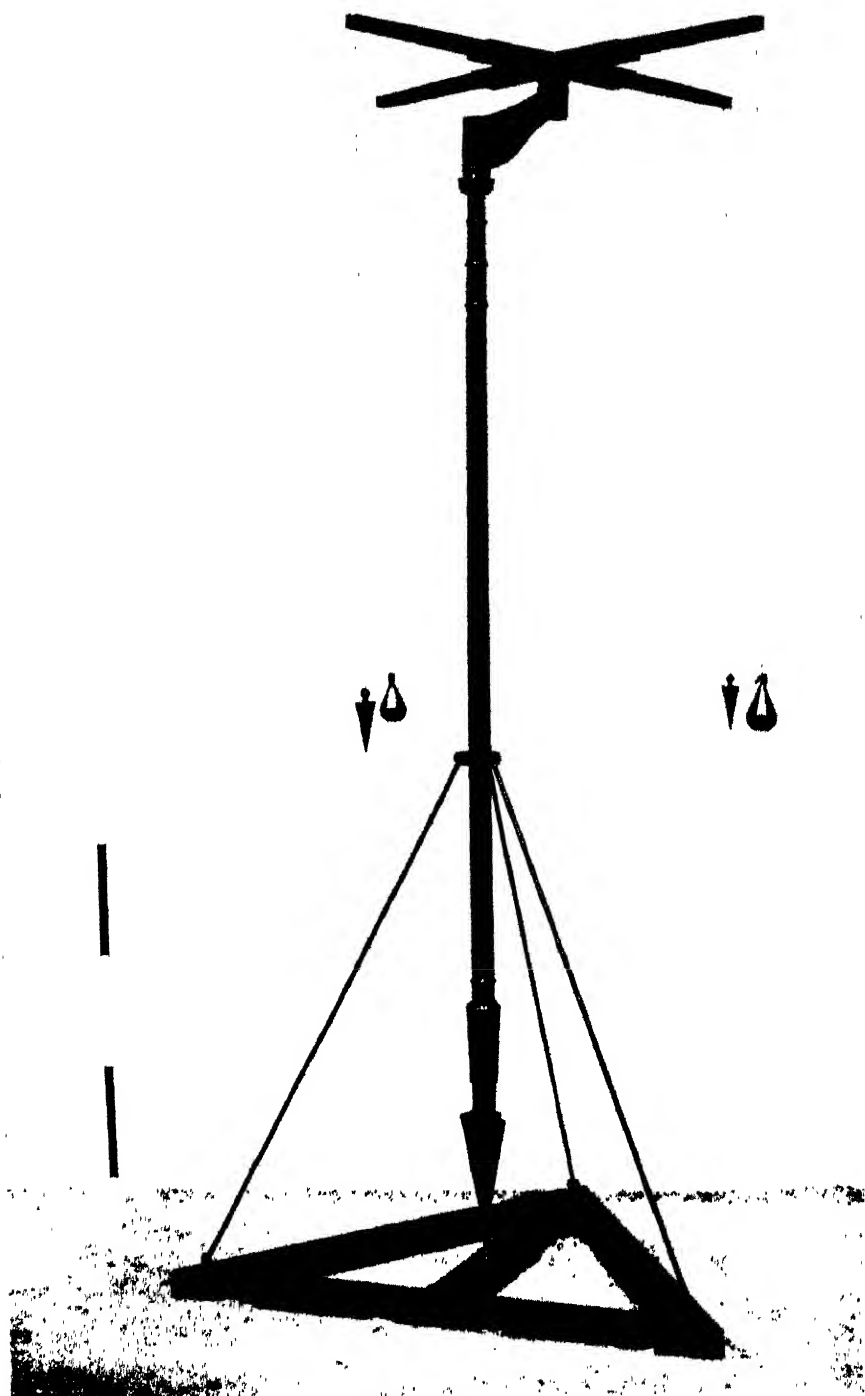
to reconstruct the dioptra we wrote to Professor Schöne hoping to get copies of the drawings he had had made about 1903. They were said to have been made by the engineer J. Neumann, and one would imagine they would have been dimensioned, and that from them it would be possible to reconstruct the instrument. Unfortunately, in his letter to us Professor Schöne said he had lost the drawings and doubted whether he could find Neumann again—I think he was dead; but he sent what he said were sketches which he had made when he was a battery commander during the war, and evidently he had been instructing his subalterns in the gentle art of surveying in olden days. Unfortunately, these are more in the nature of sketches than dimensioned drawings, and it is impossible to work from them back to the actual dimensions which Professor Schöne himself apparently thought correct. For example, the length of Hero's dioptra; the length of the levelling sight rule is given as 4 cubits, that is to say 6 feet. Now in the actual working drawings I measured up the lengths to scale, and I found the height of the instrument would be about 10 feet. That is absurd. You cannot imagine anybody using a surveying instrument and getting a ladder to climb up to sight along it. So that one could not work out the various dimensions from either the drawings in Professor Schöne's paper (*Fahrbuch d. kais. deut. archäologischen Instituts*, 14, 1899), or from the sketches. Thus I had to come to a sort of compromise and work out, roughly, as near a proportion as I could get.

Another difficulty then arose in connection with the materials of which the instrument was made; one could imagine the column of wood, whilst other parts are definitely described as metal, a metal cylinder and a metal disc; but when you start making metal plates 2 or 3 feet in size, then you get a certain amount of weight, especially in the semicircle, and it struck one that the whole thing was going to be very massive. I could not see any solution except having gangs of slaves to carry the instrument about. Sir Henry Lyons suggested that they might, as with the groma, have lined or encased it with metal whilst the actual inside was wood. That would solve the problem of mass, and we decided we would do that. But on going into smaller details we really got up against snags.

There is the question of the semicircle. On the first look one's thoughts immediately go to the altazimuth theodolite, and one is tempted to regard the dioptra as the first of such instruments, but I do not think that would be correct, for the simple reason that there is no record in Hero's text that he actually used this as an altazimuth; *i.e.* for the purpose of reducing inclined lines to the horizontal. What he, apparently, used the circle for was to enable his sights to follow a vertical plane, and therefore get a point on the same azimuth which might be lower than the point he started with. He might start sighting, and then go to the other end of the dioptra and look for a point on the same vertical plane. If he used that circle for that purpose, all I can think is that he was rather wasting his time, because in the earlier days of surveying, say about 1300 or 1400 A.D., the obvious thing was to use vertical slits. It is possible to get a good long vertical sight in that way and unnecessary to do any tilting. My own impression from a certain amount of study of surveying instruments is that the actual semicircle did not come into real use, or was not required, until the advent of the telescope; with that there was not much of a vertical field, and therefore there had to be some method of sweeping a vertical plane. At any rate, Hero did not use the dioptra as we use an altazimuth. But I fancy it might have been intended partly to act as an equatorial. It is definitely stated in his work that the instrument could be



Bronze Terminals of two Roman Ten-foot measuring rods found at Enns



Groma reconstructed from metal parts found at Pompeii by Dr. M. Della Corti

applied to astronomical purposes for measuring the angular distance between the stars, and therefore he could use it to get a polar axis and to sweep the Equator with this sight.

As regards the semicircle, again one does not know any dimensions. It is all pure hypothesis. Unfortunately, there are almost certainly several sheets missing from the codex. They are just the parts which would have dealt with the vertical semicircle. Part is well described; then there comes a rather complicated statement which nobody can follow, and then there is a blank. Hero talks about the levelling rule and describes it so closely and with such detail that one must think he must have previously described the other part. Coming to the part that he does describe accurately, the levelling rod, here again one had two little snags. There is no certainty as to how the rod was mounted.

A further rather interesting little point arises in connection with the screw on the slow-motion sighting plate. This screw is intended to elevate and depress that plate. The height of the little cylinder where the screw-head is connected to the metal plate is given by Hero as half a digit. If you take that as $\frac{3}{8}$ inch, he had to get a threaded rod with a cap on it which fits inside and is connected to the plate. A modern engineer could do that, and Neumann's reconstruction showing the method of doing it is essentially the way in which a modern engineer would do it. He splits the cylinder into two parts and makes a recess in each part to take the cap of the screw, and then he screws the cylinder on to the plate. It is very nice for a modern engineer with his B.A. threads and so on to do that sort of thing. But could they do it in Hero's time within $\frac{3}{8}$ inch?

There is also the question of the threaded rod. We have never discovered the existence of an actual threaded rod at that period. It is little points like these that rather hold one up in reconstructing. One does not want to do it in the modern fashion, of course. Though Hero gave a lot of details, they only carry one so far and then one stops. I hope that eventually we shall be able to reconstruct the instrument, because there is no doubt that in many ways it is very fine. He has a tangent screw in the general instrument, and you will notice on the top a groove which is to enable the screw to be rotated sufficiently to disengage from the cog-wheel and therefore to allow the whole instrument to be rotated quickly to within a short distance of any desired sighting. Then you re-engage again and do the slow-motion part. In other words, there is quick and slow motion. Hero describes that in great detail, and there is no doubt he was extremely proud of it—I think with great reason. You get a similar arrangement in the vertical semicircle. These are things of which we have no doubt because he describes them himself. One would be very keen to reconstruct that instrument if one could be reasonably certain of the details.

Dr. H. R. H. HALL (Keeper of Assyrian and Egyptian Antiquities, British Museum): Whilst I have had an opportunity of reading Sir Henry Lyons' paper beforehand, I have suffered from not being able to be here to hear the actual lecture, for which I must apologize. It struck me that Sir Henry had given a very interesting account of the development of Egyptian ideas on the subject of land measurement. He also touched upon the same knowledge among the Sumerians of Babylonia. Of course in both countries there was a fertile field for the growth of the science of measuring land, especially in Egypt. The whole of the cultivated land there being covered by inundation of the Nile every year made it necessary, from the beginning of royal, priestly, and private property in land in Egypt, that the soil which had arisen from the

Nile every year should be measured out, as it still is every year, anew. So that it is even more likely that land measurement grew up first in Egypt rather than in Babylonia, where conditions are not quite the same: though there was and is irrigation there, and often there are floods, there is no regular inundation. Sir Henry Lyons pointed out the great antiquity of the science or knowledge of land measurement, and he showed us that Egypt was in all probability the original home of that art and science. I am not perfectly certain, even after his descriptions, how one or two of their instruments (of which he has shown us models) exactly worked. But that is my own fault. I have no mathematical or pseudo-mathematical attainments of any kind and no mechanical knowledge; surveying instruments are not within my purview, and are beyond my scope. But there are others here who are more intelligent than I in matters of that kind, and they will no doubt be able to understand how these very primitive methods of measuring land actually worked. I hope, however, that I may be allowed to congratulate Sir Henry on his most interesting paper. In conclusion, I should like to refer appreciatively to the accuracy and beauty of the models of the *merkhet* and other examples of Egyptian measuring instruments in the Berlin Museum, which he has been able to show us. They are perfect reproductions of the originals, and reflect great credit on their makers.

Mr. HINKS: I can answer the question how the word *gromatici* got to Southampton. When Sir Charles Close was putting up those inscriptions, after rearranging and beautifying the Library of the Ordnance Survey, he wrote and asked me—I was at Cambridge—if I could get any one there to turn the inscriptions into Latin. I naturally consulted Sir John Sandys, who was unable to suggest any word in classical Latin with which he was satisfied, so used *gromatici*, from the letters of Cassiodorus, who was prime minister to the Ostrogoth King Theodoric. In the letters there is a long and interesting description of how the students in the schools of Rome were all forsaking the study of letters and art and were flocking with the surveyors in the field, for apparently surveying had become at that time a popular and profitable profession. Any one who is interested in pursuing the matter will find an interesting account of the profession of the *gromatici* in the Letters of Cassiodorus, of which I believe a good translation was published in England some twenty years ago.

The PRESIDENT: If no one else has any observations to offer I must thank Sir Henry Lyons, on your behalf, for an interesting paper, and Mr. Lancaster Jones for his interesting supplement to it. It was exceedingly valuable to hear the practical difficulties that have arisen in reconstructing the most complicated of these ancient survey instruments. I have been a digger in my time, and I have an uneasy conscience that I was really responsible for that primitive wooden instrument from the Fayum. I seem to remember it as coming from the year 1897, when, with the late Professor Grenfell and Dr. Hunt, I dug two mounds to the north of the Fayum. If so, I am bound to say we did not recognize it as a surveying instrument, and it was not the only one of that type that we found. I am sure we took it for something much more simple—something on which to wind a hank of yarn! That suggests to me this practical point. Sir Henry thought the only progress which could be made in the reconstruction of these ancient survey instruments was by a very careful examination of all ancient literature which bears in any way upon their use. I fancy that excavation will perhaps, in the end, do more. But it is necessary, if excavation is to do more, that the excavators should be aware of the existence

and nature of instruments like that in antiquity; because they will find them resolved into their parts. There is little chance of finding such an instrument complete with all parts together. The difficulty will be to recognize those parts when they are lying separately. It is very easy to mistake the nature of that sort of thing when you find it, and in a Fayum house, to neglect it and bundle it all together into some midden that you make of your less important finds. Thus knowledge may be postponed for many years, if not for ever. I wish that there had been more practical diggers here to-day; and I would suggest to Sir Henry Lyons that, if possible, he should put into the possession of the diggers some pictures of these instruments and of the conjectural restorations which have been made of them, and suggest that they should keep their eyes open for component parts which may, when put together, settle his difficulties, especially in regard to working to $\frac{3}{8}$ inch, whether it was possible in Antiquity to do that very accurate work of which Mr. Lancaster Jones spoke. That, I think, would be a practical gain from this paper, which, while it has very much interested me as an old digger and archæologist, has also convicted me in my own mind of probably a good deal of neglect which if avoided might have made the position better at this moment than it is. At any rate, I will, on your behalf, offer to Sir Henry Lyons warm thanks for a very interesting contribution and stimulating study.

ROUTE TRAVERSING IN BUSH COUNTRY

Major Basil Neven-Spence, M.D., M.R.C.P.E., R.A.M.C.

I READ with much interest Mr. C. R. Niven's description (*Geogr. Journ.*, October 1926) of the method of route traversing used by him in Nigeria during the years 1922, 1923, and 1924. I can confirm every word he says as to the practical utility of the method described, because in the years 1918 and 1919, whilst engaged in combating sleeping sickness in a part of the southern half of the Bahr-el-ghazal province, Anglo-Egyptian Sudan, which was then almost entirely devoid of roads, I used a very similar method in opening up some 800 miles of road to enable periodical inspections of the inhabitants for sleeping sickness to be carried out, and also for mapping the 369-mile road from Tembura, on the Congo-Nile divide, to Tombe, on the Nile, which was opened up at my instigation, firstly in order to prevent the northward spread of sleeping sickness, and secondly in order to improve communication with the southern part of the Bahr-el-ghazal province by giving that district a fortnightly mail *viâ* Tombe on the Nile, instead of a monthly one *viâ* Wau, on the Bahr-el-ghazal.

My traversing party consisted of an observer (myself) with prismatic compass, and three Azande, or Nyam Nyams—one who acted as wheelman, after having been taught how to read a cyclometer, one who marked with an iron-shod spear the spots where observations were made, and one who, gifted with a good carrying voice, acted as caller. The routine procedure was as follows: The starting-point having been marked by cutting a cross on the ground, the observer, wheelman, and marker

moved forward, leaving the caller on the marked spot. As soon as the cyclometer registered 0.2 of a mile the wheelman stopped the party, turned about, and hailed the caller. The latter answered with two successive cries, the first of which enabled the observer to get a rough bearing on the position of the caller, whilst the second enabled him to get an exact one. Meanwhile the marker marked the spot. If the observer were not satisfied, the hail and the two answering cries were repeated; but after a little practice this was very seldom necessary. As soon as the observer was satisfied both parties moved forward, the observer's party stopping again when the cyclometer registered another 0.2 of a mile, and the caller stopping when he reached the marked spot just vacated by the observer's party. One found in practice that it was better, whenever possible, to advance in the order described and take back bearings, because it enabled one to regulate the pace of the party, and to keep an eye on the wheelman, and to branch off in any desired direction without unnecessary shouting or delay.

To the uninitiated the taking of a bearing on a sound may seem fantastic, but those who are familiar with the African bush must often have been struck by the extraordinary facility with which a native can locate and march on a call made by another native, no matter how dense the intervening bush may be. With a little practice it is easy for the white man to acquire a degree of accuracy fully equal to that of the native. I tried several other methods of sound production, such as bugle, whistle, and drum, but abandoned them all because none of them seemed to give such consistently good results as the human voice.

Once the team had been trained it was possible to move with great rapidity whenever the route happened to lie in fairly open country or along a native path or road already opened. Thus, for instance, we covered the 369 miles from Tembura to Tombe in nineteen days, taking 1844 bearings *en route*. The greater part of the road was already in existence, and we only had to cut through some 20 miles of fairly easy bush. But if the route happened to be through thick bush, the rate of progress depended entirely on the amount of clearing which had to be done with axe and billhook to enable the party to get through. During the fourteen months I was in the southern Bahr-el-ghazal province in 1918 and 1919 my practice was to spend alternate months administering the sleeping-sickness settlement, then in process of formation, and touring the district in search of cases, Dr. Nesib Baz, my loyal and capable assistant, doing the same on the alternate months. In this way during seven months I covered some 3200 miles on foot, as the result of which the route for routine sleeping-sickness inspections was finally chosen and 800 odd miles of road were opened up, surveyed, and provided with rest-houses at intervals of 7 to 10 miles. This was in addition to the surveying of the 369-mile Tombe-Tembura road, and many other hundreds of miles of cross-country routes.

Unfortunately, owing to the acute shortage of staff and great pressure of work, which kept me fully occupied during the day and often far into the night with purely sleeping-sickness work, I was unable to plot day by day the observations made during my morning and evening marches, helpful as this would have been to me. Therefore, so far as the practical value of the method was concerned I was working largely in the dark, not a little apprehensive that it might prove to be small, but buoyed up with the thought that at any rate so far as my successors were concerned almost any results would be better than none. Plotting had thus to be deferred till I found leisure to do it during subsequent leave of absence. The drawing was then done with scrupulous care on the scale of 1/50,000, using squared paper, a protractor, and a very fine-pointed pencil. The first traverse I plotted was the earliest one made, a roughly circular tour of 170 miles westwards from Tembura. The end point of this traverse on the map proved to be separated from the starting-point by a distance which represented less than $2\frac{3}{4}$ miles on the ground. This seemed too good to be anything but a fluke, but a succession of similar results soon convinced me that the method was astonishingly reliable and accurate, as it was rare indeed to get an error of as much as 3 per cent.

During a subsequent visit to Tembura in 1923 I put the method to the following practical test. It was necessary to straighten a 3-mile section of the road connecting Tembura with the sleeping-sickness settlement. The existing stretch of road was carefully surveyed by the method described and the observations plotted. Starting at the first selected point and working on the bearing obtained from the map, we cut straight through some $2\frac{1}{2}$ miles of comparatively thick bush and hit the road again within a few yards of the second selected point. Shortly afterwards I carried out an even more searching test. Owing to the increased prevalence of sleeping sickness in the vicinity of Tembura itself, it was necessary to organize arrangements for intensive inspections in this area. I therefore surveyed and mapped a 10-mile stretch of the Yubo river, together with the whole course of all the tributaries debouching into it, and fixed the position of the various headmen's houses. Then, starting from Tembura and using the bearings obtained from my map, I cut straight roads from point to point throughout the area, in every case arriving within 100 yards of the point aimed at after marching on the bearing and covering the distance indicated by the map. The two halves of the main circular road, 14 miles on the left bank and 8 miles on the right bank, ended on the map at the Yivule rest-house, the actual end points on the map being separated by a distance which represented less than $\frac{1}{4}$ mile on the ground. It was only necessary to swing each arm 1° to make the two points coincide.

It is clear that on grounds of simplicity, speed, accuracy, and applicability to bush country the method of route traversing described should

be of great value to those officials, frequently understaffed and usually ill equipped, who from choice or necessity spend their lives administering the primitive parts of Africa. Properly fixed points, even where such exist, are of little more than academic interest to the local official, who, for administrative purposes, needs reasonably accurate detail on a scale of not less than 1/250,000. I feel, therefore, that I need offer no apology for encroaching on the pages of the *Journal* with a description of a method which seems to answer the purpose fully.

[A large file of records, plotted traverses, and route maps, which was sent by Major Neven-Spence with the above paper, is deposited in the Library.]

THE DIAMOND FIELDS OF SOUTH-WEST AFRICA

Die Diamantenwüste Südwest-Afrikas : zugleich Erläuterungen zu einer geologischen Spezialkarte der südlichen Diamantfelder 1 : 25,000 aufgenommen von W. Beetz und E. Kaiser.— Edited by Erich Kaiser, with contributions by W. Beetz, J. Böhm, the late R. Martin, H. Rauff, M. Storz, E. Stromer, W. Weissermel, W. Wenz, and K. Willmann. 2 vols. Berlin : D. Reimer. 1926. 12½ × 9½, (vol. 1) pp. x. + 321, 13 maps and 4 plates ; (vol. 2) pp. vii. + 533, 52 plates and 32 stereographic photographs. Coloured frontispiece by Axel Eriksson.

THE economic importance of the diamond fields of South-West Africa has led to their detailed study and the preparation by E. Kaiser and W. Beetz of a six-sheet map of the Namib or coastal district. This map includes about 40 miles of the coast north of the Orange River, extending about 8 miles inland, and it is accompanied by others on a larger scale of special areas, and by some illustrating particular problems. The character of the country depends on the interaction of geographical and geological factors, and both aspects are well represented on the maps. Dr. Kaiser began his field work in 1914 and remained in South-West Africa until 1919. The results of the observations of himself and his colleague, W. Beetz, and the reports by eight other authors on their collections, are now issued in two large and magnificently illustrated volumes. The publication of the results of the survey in one work has the drawback that the two volumes are ponderous to handle, and as the maps were printed between 1922 and 1925, and the printing of the text began in 1924, there are some serious differences between the maps and the present interpretation of the evidence. Thus some marine beds are assigned on the maps to the Miocene, but have been proved by Böhm to be Eocene—a difference important in its bearing on other parts of Africa. The collected issue of the results is convenient for reference, and the monograph constitutes a most valuable contribution to African geography and geology.

This part of South-West Africa consists in the main of a folded belt, in which the axes are in general parallel to the coast. This belt lies against the unfolded plateau, and has been traversed by three rift valleys, which trend at a high angle with the coast. The foundation of the country consists of primæval schists and gneisses, which are intruded by ancient granites and covered in places by two sets of unfossiliferous stratified rocks, each containing much dolomite ; the lower, the Konkip Formation, contains some schistose dolomite, and is regarded as pre-Palæozoic : the upper is described as the Nama System,

and is correlated doubtfully with the Cambrian, though its pre-Cambrian age would appear on the whole more probable. Then follows a long unrecorded interval: the next rocks are the Jurassic dolerites of the Karroo—which are described by Willmann—and then an interesting volcanic series consisting of lavas rich in alkali, such as the phonolites of the Klinghardt Mountains, and melilite basalts. Dr. Kaiser gives the name Klinghardtite to a variety of phonolite in which the nepheline has been greatly altered; this rock and the coarse-grained porphyritic phonolite with which it is associated, are similar to the Kapitian phonolite, the oldest lava in the great volcanic period of Kenya Colony. The age of the volcanic eruptions of South-West Africa is determined as either Upper Cretaceous or Eocene, which is the date assigned to the Kapitian series in Eastern Equatorial Africa. This age is proved for the Klinghardt volcanoes, as they are later than the Lower Cretaceous, and pebbles of the phonolite occur in the Middle Eocene gravels. The evidence for age is less definite in Kenya Colony, and the establishment of the date of the melilite basalts and phonolites of South-West Africa is a valuable contribution to the volcanic history of Africa. The age of the lavas is fixed by the marine beds of the Bogenfels diamond field: a series of fossils including Bryozoa, molluscs with the nautilus *Aturia*, fossil sharks and other fish, which are described by Böhm, are Middle and Upper Eocene. A remarkable coral is interpreted as a survivor of the Stromatoporoids, a group long regarded as having become extinct in the Devonian.

In a report on the land and freshwater fossils Dr. Stromer discusses their bearing on the geographical relations of Southern Africa, and shows that the mammals give no evidence of any land connection with South America in or after the Miocene. He also holds that there is no confirmation of Tullberg's view that in the early Kainozoic South-West Africa was separated by an arm of the sea from East Africa, which was then joined to Madagascar.

The coastal terraces include an old series of which there is no proof of a marine nature; later raised beaches occur at the heights of 40 metres, and still younger beaches at from 5 to 10 metres above sea-level.

After the retreat of the Eocene sea the country became a desert, and the development of desert topography is discussed in detail in an interesting chapter by Kaiser on the factors of desert formation. He attributes the influence of the wind mainly to deflation (the distribution and heaping up of sand and dust by the wind) and to corrasion (a term which he uses for the scouring, grooving, hollowing action of wind-borne sand). Herr Storz describes the cherts produced under the same conditions by silicification and by deposition in water, and Rauff the fossils in the pre-Eocene cherts.

South-West Africa seems to have been a country always liable to desert conditions. The ancient Nama sandstones have abundant ripple-marks like those of dunes. The Upper Cretaceous and Lower Eocene land showed a transition from a moderately to an extremely arid climate. The advance of the Middle and Upper Eocene sea produced moister conditions; but the Miocene was marked by semi-arid conditions and was followed by a relapse to extreme aridity. There appears no evidence of a still increasing drying up of the country in historic times, such as has often been asserted. The last movement described has been a slight fresh advance of the sea with a somewhat moister climate. The severest desiccation was pre-human.

The Bushmen, the aborigines of this district, are discussed in a memoir by the late R. Martin, who quotes the rival views regarding the purity of that race; he concludes that no race is quite pure, that the Bushmen are so

essentially, that their nearest kin are the Hottentots, and that they have not been influenced by a Phœnician intermixture. He describes some Bushmen skulls and remains of skeletons collected during the survey.

The most important economic mineral of this part of South-West Africa is the diamond, which occurs in sands along the coast. According to a widely accepted theory the diamonds have come from basic igneous rocks now under the Atlantic, and have been washed ashore and carried north by the Benguella Current. Dr. Kaiser insists that except during part of the Eocene the sea can have played no part in the distribution of the gems. He considers that they came from the interior, where they were formed in association with various igneous rocks, and that they were subsequently included in an extensive sheet of sandstone. From this bed they have been carried into many later alluvial deposits, the richest concentration being by Eocene rivers. The diamonds are associated with native gold and copper, iron, and manganese oxides, and with zircon, garnets, epidote, sillimanite, tourmaline, topaz, monazite, quartz, feldspar, etc. This association does not suggest an ultra-basic volcanic source, but formation by contact-metamorphism combined with the action of superheated acid steam. The diamond fields in many respects resemble that recently discovered by Kitson on the Gold Coast, and as there, the diamonds are small—the largest known weighing only 50 carats—but of high quality.

Many of the photographic illustrations are pasted in place and are clearer than such figures usually are when printed with the text. The work has an excellent bibliography and index.

J. W. GREGORY.

SURVEY OF INDIA GENERAL REPORT, 1924-1925

IN this latest issue there is an important departure from previous practice in the form of the Survey of India annual departmental report. Leaving this change and other important changes foreshadowed for later consideration, those interested in Indian maps and surveys will first turn to the record of progress made in the main task of the Survey of India, the topographical survey of the country and the preparation of maps from it.

Table 1 of the abstract of topographical work shows the steady progress made. In 1913-14, the last year unaffected by the war, the annual out-turn had risen to about 56,000 square miles; it had fallen to under 14,000 in 1918-19, the year most affected, and since then it had gradually risen to over 61,000 in 1922-23. The reduction to 44,000 square miles in 1924-25 is clearly to be accounted for by the exceptionally high proportion of large-scale work, and perhaps also, to some extent, by the retention of the headquarters and a portion of a topographical party on drawing during the field season.

The 1-inch map of India includes some 6000 sheets. About 2000 of these will probably not be surveyed and published on the 1-inch scale, the country they cover being, at present at any rate, capable of adequate representation on a smaller scale. Over 2000 sheets have now been published, so that the work may be considered as half done, but it is to be expected that an increasing proportion of the areas allotted to 1-inch survey may be found, as the country develops, to require survey on a larger scale.

The complete $\frac{1}{2}$ -inch and $\frac{1}{4}$ -inch maps will cover some 1600 and 450 sheets respectively, of which 450 $\frac{1}{2}$ -inch sheets and 125 $\frac{1}{4}$ -inch sheets have been published.

The standard geographical map is "The Map of India and Adjacent Countries" on the 1/Million scale. Two of the sheets were published during the year under review, and the index chart in the Map Publication volume shows that the map is now available for practically the whole of India, except the provinces of Assam and Burma, of which the sheets are still in hand, and for large areas outside India to the west and north.

India is taking its part in the preparation of the International Map of the World. No Indian sheet of the map was produced during the year, but fifteen of the sheets which include portions of India were previously available, and seven more are in preparation.

None of the sheets of the general map, called "The Southern Asia Series," was published in 1924-25, but eight are in existence and eight more are in hand.

Turning to the geodetic results of the year: although work in connection with the primary triangulation, which was stopped during the war, has not yet been resumed, deflection and gravity observations were made at a number of stations, astronomical latitudes being obtained in Kashmir and in Assam and Bengal, and pendulum observations made in the Panjab and Kashmir. It is interesting to see that "the Assam and Bengal results show that the Hayford theory of uniform isostatic compensation is very imperfectly realized in this area."

A length of 1100 miles of primary levelling was done as part of the new geodetic level net.

Tidal observation and prediction were continued, and the Admiralty was supplied with predictions for seventeen ports for 1926. In the computing work, special mention is made of the computations for Dr. Hunter's investigation of the figure of the Earth.

Solar photography, which the Survey of India has carried out since 1878, has been made over, for reasons of economy, to the well-equipped observatory established at Kodaikanal.

Among items of particular interest in the general work of the year, mention must be made of the completion of the air-survey, scale 3 inches to the mile, of 1400 square miles of forest in the Irrawaddy delta, of which the photography and preparation of mosaics were done during the previous year. Air-survey was employed again, this time on the survey of inaccessible areas on the North-West Frontier, and experiments were begun in connection with the use of the method for cadastral surveys, the results of which will be awaited with interest. Cadastral surveys are becoming increasingly important throughout the world, and any method by which the great costliness could be reduced would be very welcome.

The large out-turns of some of the topographical parties are significant. Three of the parties surveyed between 7000 and 9000 square miles each, more than half of which was original survey. Nearly two-thirds was 1-inch work, and the rest $\frac{1}{2}$ -inch. Quantity of out-turn is in itself an inadequate criterion of the efficiency of a party, so much depending on the nature of the country surveyed, but these are remarkably good out-turns for any sort of ground.

Some important exploration was achieved by Khan Sahib Afraz Gul of the department, who was attached to Mr. and Mrs. Visser's expedition which explored the tributaries of the Hunza River and their glaciers (see *Journal*, 68, p. 458). The Khan Sahib's survey, "which emanated from the stations of the Indo-Russian triangulation of 1913, was connected to fixed points of the Survey of India, a small adjustment only being necessary." His total out-turn was nearly 2600 square miles of $\frac{1}{2}$ -inch exploration survey, in country some of which is described as "probably as difficult as any in the world."

By these surveys the earlier work of Sir Martin Conway (1892) and Mrs. Bullock Workman (1908) can now be coordinated. It is satisfactory to learn that the leader of the expedition expressed "his very high appreciation of the energy, courage, and skill displayed by Khan Sahib Afraz Gul."

It was laid down in the early days that the energies of the department, outside the geodetic branch, should be confined, as much as possible, to topographical survey and mapping; but much other work is now being done for civil administrations, local surveys, and the Public Works Department. There can be no doubt that the new policy has increased the general value of the Survey of India to the country. The practical difficulties are great, and the Survey is to be congratulated on the extent to which they are being overcome.

One of the most useful items of special work carried out during the year was the execution of secondary and tertiary levelling in connection with irrigation and railway projects, and the like. By itself carrying out levelling operations of this sort, it is possible for the Survey to prevent in future the confusion which inevitably occurs when different agencies, uncontrolled by one scientific authority, scatter their conflicting values over one and the same region—a confusion not unknown even in Europe.

The new division of the Northern and Southern Circles into three circles (Frontier, Southern, and Central) should, as the Report points out, increase professional control and help to ensure the due coordination of all survey work of any extent or importance.

Other advantages which it is hoped to secure are a closer touch with the Survey requirements of the army and improvement in the mobilization arrangements of survey units for war. Experienced survey officers will be stationed at the headquarters of the Northern and Western Commands, with the necessary skeleton cadre of a survey company in each. It is hoped eventually to maintain an air-survey section with each company.

Another change foreshadowed in the Report is the preparation of a new series of sheets on the scale of 2 miles to 1 inch. Work in connection with this was done by the headquarters and the nucleus of a party during the field season, a rather unusual arrangement. The additional series would appear to be somewhat of a luxury, seeing that India is preparing complete series on the $\frac{1}{2}$ -inch, $\frac{1}{4}$ -inch, and 1/Million scales, and that about three-quarters of the work on the two first of these has yet to be done; but the new map is intended specially for flying men and motorists, and it is possible that the demand is a strong one. As the map will include large areas not yet covered by modern survey, the task of its preparation will be no light one if the results are to be satisfactory.

The present issue of the General Report includes only brief abstracts of the out-turns of the geodetic and mapping work, and gives no indication of the progress being made generally in Indian geodesy and mapping; it concentrates on the work of the ordinary field parties and detachments. Information regarding geodetic and cartographic work is now given in two special volumes, the old General Report being thus replaced by three volumes, 'The General Report,' 'The Geodetic Report,' and 'The Map Publication Report.'

Judging from the first and third of these volumes (the Geodetic Report is apparently not yet available), the new reports have been carefully prepared and many minor improvements have been made. Soon after the reorganization of the department, which followed the India Survey Committee of 1905, the old system of one fairly comprehensive and technical General Report for the department was found unwieldy, and the detailed descriptions of the year's

working were relegated to a separate volume, known as the Record Volume. The present change is a further move in the same direction, the general abstract being cleared of still more of the technical information. At the same time it has been cleared of some general information and is mainly concerned with field work.

There is perhaps some advantage to the Government and the public in the exclusion from the General Report of a certain amount of technical detail: for instance, there is the substitution of a single comprehensive index map showing the progress in survey and topographical mapping, for the old complete series of seven index maps now included in the Map Publication volume. On the other hand, there will be some inconvenience in having to refer to three volumes. The mapping and publication of the field work is really a part of topographical operations, and the gradual completion of the smaller-scale geographical maps is also an important part of the main task of the department. It would probably make future General Reports more useful if some brief indication of the progress made in these directions and in geodesy were included in them, leaving all technical detail to the special volumes. Such details as those regarding the printing of the minor publications might perhaps be relegated to the Map Publication Report.

Under the system inaugurated by the report for 1924-25 the period dealt with by the Map Publication Report is not the same as that dealt with by the General Report. The survey year in India begins on October 1, about which date the parties take the field. The "publication" year, however, now begins on April 1, in order to conform to the financial year, so that the area reported in it as drawn by a party will no longer be the area that is reported in the General Report of the same date as surveyed by the party. This is perhaps not a very important matter, but it may possibly confuse those outside the department who consult the reports.

A sketch of the services of Khan Bahadur Sher Jang, one of the most distinguished Indian officers of the department, who retired in 1925, is added as an appendix to the General Report, and its frontispiece is a well-executed photogravure portrait of the same officer. The long list of war and political services and explorations, the references to their dangers and hardships and to their valuable results, make, with the graceful appreciation of the Khan Bahadur's private character, a record of which the brotherhood of surveyors may be proud.

W. M. C.

THE UNSTABLE EARTH

Our Mobile Earth.— Professor R. A. Daly. New York: Charles Scribner's Sons. 1926. Pp. xxiv. + 342. 188 *Maps, Diagrams, and Photographs*. 21s. net.

Regions of Compression: Presidential Address to the Geological Society of London.— Dr. J. W. Evans. F.R.S. *Q. J. G. S.*, vol. 82, 1926, pp. lx.—cii.

THIS fascinating and beautifully illustrated book, which attempts to sketch the main processes by which the Earth has attained its present shape, structure, and surface features, contains the substance of a series of popular addresses given during January 1925, at the Lowell Institute of Boston. Professor Daly is well known throughout the geological world as a brilliant exponent of the method of multiple working-hypotheses, for the

creation of which he has an unrivalled facility. At a recent dinner of the Geological Society of America the younger spirits of that assembly welcomed their Harvard colleague with a song appropriately beginning:

"Every morning in the year
Daly has a new idea!"

In this boldly planned book we are given the harvest of his recent speculations. Fortunately the book is much more than that, for while scientific guessing may be out of date by the time it is published, the evidence remains. Daly is an indefatigable collector of data, and his method of presentation of the facts is as complete and as attractive as his industry and easy picturesque style can achieve.

The book fittingly begins with two chapters on earthquakes, which constitute by far the best popular review of that difficult subject that has yet appeared. Prof. Daly quickens the imagination whether he is dealing with destruction of life or remedial measures, the measurements of earthquakes or the messages they bring from the hidden depths. He restores a sense of proportion by pointing out that the death rate by earthquakes is only "one-sixth of the rate at which the automobile is destroying lives in the United States alone," and while he keeps the human drama in the foreground he skilfully works in the leading results of modern seismology, and the records of seismographs cease to be dryly technical.

The third chapter deals with the interior of the Earth, and here, unfortunately for some of the later speculations, the evidence which has become available since the book was prepared leads to very different conclusions from those advocated by the author. It is suggested that the continents consist essentially of a layer of granite averaging 34 miles in thickness, lying on a few miles of "crystallized basalt," which in turn is underlain by less dense "glassy basalt." Beneath the oceans granite is absent, but the crystalline basalt goes down more deeply than the corresponding layer beneath the continents, and finally merges into the universal substratum of plastic glass. There need be no hesitation in rejecting this conception as unsound. In 1924 Gutenberg interpreted the data for seismic waves of the long or surface type which had passed through the foundations of Eurasia to indicate 30 km. as the average thickness of that great continental area. Stoneley however pointed out that dispersion effects had not been taken into consideration, and Jeffreys then found that a more rigorous discussion led to an estimate of 15 km. for the thickness of the *sial*. Still more recently Jeffreys has found that compressional waves are transmitted through a superficial layer of 10-15 km. in thickness with a velocity of 5.6 km./sec. This agrees exactly with the velocity in granite as calculated from the density and compressibility of granite at corresponding pressures. Next there is an intermediate layer of about the same thickness in which the velocity is 6.2 km./sec. This satisfies the data for either basaltic glass or diorite. Of these alternatives diorite is by far the more probable (see *Nature*, 23 October 1926, p. 586). Still deeper the velocity rises to 7.8 km./sec. The available work on the compressibility of rocks at high pressures—carried out by L. H. Adams and his colleagues at the Carnegie Institution of Washington—suggests dunite (a peridotite composed essentially of olivine) as a possible material at these depths. But since basaltic material almost certainly underlies the continents as well as the oceans, it is likely that the *sima* is composed of eclogite (a high-pressure and dense facies of basaltic material) passing down at some depth still unknown into peridotite. But quite apart from this alternative interpretation the seismic data are clearly fatal to Daly's conception of a granite

layer 34 miles thick and a substratum of glassy basalt extending downwards from a depth of about 40 miles.

Another argument against a thick granite layer depends on the radioactivity of the rocks and the consequent generation of heat within them. All the internal heat lost from the surface of the continents can be fully accounted for by a layer of granite and diorite only 20 km., or 12 miles, in thickness. As the material from greater depths—represented by the plateau-basalts of every continent—is also radioactive, it seems certain that even with a limited thickness of *sial* the heat generated below must accumulate and lead to fusion. This is an aspect of the mobile Earth that Daly fails to develop. He ignores the implications of radioactivity except for the statement that “radioactivity means the steady evolution of heat.” Had he followed up the logical consequences of the heat developed within his substratum of glassy basalt he would have reached conclusions even more catastrophic than those of Professor Joly.

On the premises adopted Prof. Daly has no need to meet the great difficulty which formerly stood in the way of explaining vulcanism, namely the necessity for supplying latent heat to provide magmas. His basalt is already a hot glass which on relief of pressure, as for example at the base of a tension cleft, becomes mobile and works its way upwards, aided later on by the effervescence of escaping gases. In order to provide conditions whereby both fissuring and mountain building can be simultaneously produced, the deformation of the Earth by distortion on a planetary scale is next considered. The three co-operating causes to which appeal is made are contraction by cooling; retardation of the rate of rotation; and denudation of the lands. As a result of these or other processes the surface has been furrowed into huge gently sloping domes and basins, and it is suggested that the crustal layer of granite, thus thrown out of level, broke up into fragments comparable with the existing continents. Moreover, the fragments, no longer securely anchored, became gigantic landslides and migrated down the slopes of the domes, crumpling the weaker belts in front of them into mountains, and leaving behind them the open spaces of the oceans. In this way Daly attempts to provide a force capable of overcoming the resistance to continental migration. He believes all the older theories of mountain building to be inadequate, and finds a solution of the mystery in the revolutionary conceptions developed independently by Taylor and Wegener. But he rightly warns the reader that “speculation is not science or knowledge.” The really valuable part of the discussion is the vigorous description of the surface structure of the Earth as a whole and the able summary of the obdurate riddles that have to be faced.

The final chapter deals with the origin of the Earth—preference being given to the views of Jeans and Jeffreys—of the continents and of the moon. The existence of continents is recognized, for the first time in a popular book, as one of the principal mysteries of nature. A further special difficulty is to explain their asymmetry. This peculiarity of distribution has generally been ascribed vaguely to the catastrophic birth of the moon from the Earth's flank. According to Jeffreys, however, the separation of the moon could only occur when the viscosity was such that the outer zones of the Earth would speedily become once more symmetrical. Daly tries to avoid this difficulty by suggesting a primary hemispherical asymmetry deep within the interior which persisted even after the tearing off of the moon. Here we are literally out of our depths and must be content to await further evidence. The Earth keeps its own archives of its fantastic adventures, and there is no need to despair because some of them are still hidden or remain indecipherable.

It is only fair to point out that Professor Daly is far from being dogmatic. His guesses and speculations are clearly recognizable as such, and whether one is in sympathy with them or not they serve as a condiment to the solid meat of a very satisfying intellectual meal. "The poetry of Earth is never dead," and in this stimulating book our author has rejuvenated a sense of romance and mystery which will be felt by all its readers.

Complementary to his Address on "Regions of Tension" (reviewed in the *Journal* for March 1926) Dr. J. W. Evans has now expounded his views on the phenomena and structures that indicate the existence of compression in the Earth's crust. His treatment of the subject is packed with suggestive ideas; but the problems are baffling, even the evidence itself is almost incredible, and opinions as to interpretation are as diverse as the number of the authors who have discussed them. It is therefore no matter for surprise that the Address under review is particularly provocative of criticism. It was hoped that Dr. Evans would consider the effects due to the release of energy involved in the atomic decay of uranium and thorium. Clearly however he is not prepared to go far in this direction, for at the outset he suggests that a considerable proportion of the energy liberated by the radioactive elements in rocks is not converted into heat, but is used up in effecting endothermic changes in the surrounding minerals. When the heat developed by radium is experimentally determined the glass container becomes intensely coloured by the rays, just as minerals do in natural circumstances. If Dr. Evans' suggestion were valid we should expect that the heat so determined would be considerably less than the heat-equivalent calculated from the number and energies of the rays themselves. But the two are equal within the limits of experimental error, and the expenditure of energy by other processes than conversion into heat must therefore be much less than 1 per cent. of the total. We can only conclude with Lord Rayleigh and R. W. Lawson, that the evidence is definitely against Dr. Evans' proposal for thus disposing of radio-activity.

To decide whether the contraction due to cooling is sufficient to account for the observed folding and overthrusting of the rocks Dr. Evans appeals to the work of Dr. H. Jeffreys, who has shown that in an earth that has been continually cooling for 1600 million years the area of the surface will have decreased by over 4 million sq. km. The principal mountain ranges of the present day indicate a decrease estimated by Jeffreys at about half this area. Dr. Evans points out, as other authors have done, that most of the older folded regions are no longer mountainous. Such are the Hercynian, Caledonian, and pre-Cambrian foldings representing the sites of ancient ranges now worn down by long-continued denudation. But while Dr. Evans justly considers the observed compression to be far greater than the calculated amount, he also shows that there is reason to believe that the latter has also been underestimated. The contractions involved in crystallization from amorphous magma; in loss of volatile constituents; in change of facies producing minerals of lowered molecular volume; and in the slowing down of the Earth's rotation have not been allowed for in the cooling theory. Moreover, the Earth's outer shell may be increased in area by normal faulting; by the filling of fissures by dykes; and by hydration (as, for example, in the conversion of peridotite to serpentine). All of these processes add to the possible amount of crumpling.

The change of form due to reduction in the rate of rotation implies, as is well known, a decrease in the equatorial diameter. Long ago Chamberlin

deduced that this would involve the production of mountain chains lying across the equator, and since such ranges are infrequent he concluded that any considerable change in the rate of rotation was improbable. Dr. Evans, however, points out that the contraction due to this cause would lead to flowage at all depths towards the poles, distorting the Earth in such a way as to extend the continents laterally north and south—presumably by diagonal shearing. For a different reason continental areas near the poles would tend to drift towards the equator. It is also suggested, as in the first Address, that a drift towards the Pacific may have occurred, this movement being dependent on the possibility that the Earth's centre of gravity may not correspond with its centre of form.

Dr. Evans has rendered valuable service in thus revealing the extreme complexity of the interacting processes. He goes on to ask why the manifestations of contraction are concentrated in particular tracts, and confined to specific periods of time. To illustrate the problems examples are taken from the geological record of the British Isles and adjoining countries. The detailed discussion of the events that culminated in the Hercynian Earth storm, and of the later events that led to the still greater Alpine revolution, provides an admirable study of the two best-known cycles of Earth history, and will be widely appreciated by geologists of all shades of opinion.

Unfortunately, no satisfactory explanation of the origin of geosynclines yet appears to be forthcoming. Dr. Evans refers the depression of a uniform sea floor in the first place to localized accumulation of sediments, and afterwards to downfolding by gentle lateral pressure. This would imply a defect of gravity which in the writer's opinion would be far in excess of known departures from isostatic equilibrium. The analogous Gangetic Plain does in fact show a defect of gravity, but this can be alternatively explained by the concentration near the surface of sediments of low density. But geosynclines, however they came into existence, localize tracts in which the underlying crust is bent down into regions of higher temperature and thus doubly weakened. Later, "the time arrives when under the slowly increasing horizontal compression the subsided area yields and closes, so that the contained sediments are forced up in folds to form a new mountain range."

In recent months a good deal of work has been done on the average thickness of the *sial*, or lighter rocks of the continental areas. Ignoring the full thermal effects of radioactivity and assuming that the deepest folds go down to a depth of 86 km. below sea-level, Dr. Evans calculates the thickness of the *sial* of the plains to be a little over 40 km. But several independent lines of evidence suggest that this thickness cannot much exceed 20 km., and accepting this more direct estimate one can reverse Dr. Evans' problem and determine the maximum depth of folds to be about 40 km. below sea-level for mountains standing 5 km. above sea-level. The nature of the evidence was outlined above in discussing Daly's 'Our Mobile Earth.'

Notwithstanding the disagreement over radioactivity and the thickness of the continents, we are indebted to Dr. Evans for a masterly survey of a difficult subject such as has rarely appeared in English and which is well in advance of recent Continental work. Direct observations on the rocks themselves are of more value than the discordant notes of interpretation, and in this Address we have a valuable summary of years of work on the complexities of North Devon and adjoining tracts.

ARTHUR HOLMES.

GEODETIC OBSERVATIONS AND TRIANGULATION IN KASHMIR (DE FILIPPI EXPEDITION, 1913-14)

Spedizione Italiana De Filippi nell' Himàlaia, Caracoràm e Turchestàn Cinese (1913-14).— Series I. Geodesia e Geofisica. Vol. I. Astronomia Geodetica, Geodesia e Topografia. Alberto Alessio e Giorgio Abetti. Bologna: Nicola Zanichelli. [1925.] 12 × 8½, pp. xxxv. + 415. *Map, 51 Plates and Charts.*

THE Introduction to the volumes of Series I., by Dr. De Filippi, gives an admirably concise account of the whole campaign from its first inception. The thorough scientific exploration of the broad zone between the Punjab and Chinese Turkestan (including, therefore, the Western Himalayas, the Upper Indus Valley, the Southern Karakoram, and part of the highest plateau in the world), which was the object of this expedition, might have remained an ambitious dream but for the energy of its authors and the whole-hearted cooperation of His Majesty the King of Italy and of the Italian Government. The scientific branches of the Army, the Navy, and the Universities contributed not only experts but most of the scientific instruments. Financial support came mainly from Italian sources, but also from many foreign scientific societies, including the Royal Geographical Society. Dr. De Filippi writes most warmly of the debt of gratitude which the expedition owes to the Government of India for interesting the Maharajah of Kashmir and his officials in the work, for permitting the close cooperation of the Indian Survey and the Observatories Departments, and for the loan of experienced officers.

The scientific exploration was necessarily divided into two groups: (1) the *instrumental group*, under Captain A. Alessio (lately hydrographer of the Italian Navy), and Prof. G. Abetti, who were in charge of the geodetic, geophysical, and meteorological measurements and observations, the results of which form the subject-matter of the three volumes of Series I. (2) The *exploratory group*, under Prof. G. Dainelli, in charge of the geological, ethnographical, and geographical investigations, the results of which form the matter of the nine volumes of Series II.

The complete instrumental equipment, with the personal effects and camp equipment of the Europeans, weighed 4 tons, and required for their transport alone 60 ponies and 20 porters. The supplies of European food (over 6 tons) necessitated a corresponding additional transport quite apart from the fodder and the food for the natives required during the six months spent in the Upper Indus Valley. It was no light task to organize beforehand this mass of material so that it could be subdivided almost at will and leave individuals free to move in any direction with their proportion of instruments and supplies.

From the arrival of the party at Bombay on 22 August 1913, not a day was wasted. A thorough geological and glaciological examination of the Vale of Kashmir, and the fixing of several geodetic stations between the Zoji-La and Skardo, occupied most of September. The next seven months were spent in strenuous winter work in the Upper Indus.

Meanwhile over 50 tons of food for the caravans and fodder for the horses and yaks had been collected, partly from Kashmir, partly from the Punjab, in the vicinity of Leh, and the whole expedition assembled without a hitch early in June 1914, a few miles south of the Karakoram Pass, on the Depsang Plains (17,590 feet), which had been selected as the headquarters of the expedition during its three months' sojourn in Eastern Kashmir.

Part I. Geodetic Astronomy, pp. 5-230.

Chapter I., by Prof. G. Abetti, gives in detail the various observations by Captain Alessio and himself and the methods adopted in determining eleven principal latitudes. The probable errors varied between $\pm 0''\cdot 16$ and $\pm 0''\cdot 34$, a degree of accuracy which might be expected in major geodetic operations, but unprecedented in the course of an exploring expedition in remote regions and under most unfavourable physical conditions.

Chapter II. is concerned with time determinations, also by Prof. Abetti. Here, as elsewhere, can be seen that remarkable attention to detail which distinguishes the methods of these two observers. The observations were undertaken partly for the determination of the difference in longitude between the various stations of the expedition and Dehra Dun, and partly for finding the rates of the chronometers and especially the rates of the instrument used for timing the pendulums in the gravity observations, the results of which have not yet been published and are awaited with great interest.

Chapter III. Astronomical Determinations of Longitude.—Prof. Abetti opens with a brief historical sketch of experiments in the use of wireless time signals prior to 1913, when radiotelegraphy was still in its infancy. In succeeding paragraphs he describes the apparatus and the methods used in the Italian expedition. At that time there was no great wireless station in India from which controlled time signals could be sent out regularly, but it was arranged that the small wireless station at Lahore should send signals (Plate XVIII.) to be received at Dehra Dun, and in the field. There is a detailed account of the conditions which favoured or prevented the reception of the signals at the various stations, and full particulars of the determination of the exact longitude of the transit instrument at Dehra Dun and of five stations in Kashmir, viz. Skardo, Lamaiuru, Leh, Dopsang (connected with India by triangulation), and of three stations in Chinese Turkestan, viz. Sughet Karol (hitherto unfixed), Yarkand, Kashgar.

Chapter IV. Nautical Methods applied to Land Operations.—Captain Alessio discusses in considerable detail the value of the methods employed in the Italian Navy, in view of their comparative simplicity. He puts forward arguments for the exclusion of a Prismatic Astrolabe and for preferring the Zenith telescope and Transit Instrument for accurate determinations, and the use of the sextant for minor stations where portability was of first importance. The rest of the chapter contains minute details of the preliminary tests on the chronometers, and of the watch kept on the rates of each individual instrument; and further, an account of the determination of seven differential longitudes with the sextant and chronometers.

Part II. Geodesy and Topography, pp. 235-415.

Chapter I. The Determination of Station Coordinates.—Captain Alessio gives the details of the methods adopted by Prof. Abetti and himself for determining the coordinates of all the gravity and magnetic stations. In some cases, e.g. Skardo, the work amounted to a triangulation of the whole basin (see Plates II. and III., vol. 8, Series II.), and in this connection a valuable investigation was made (pp. 254-266) on the behaviour of *invar* wire at temperatures below 0° C. The coordinates of twelve stations are printed *in extenso* together with the coordinates and altitudes of all important points visible from the central stations. Among the plates will be found panoramic photographs of all these stations; on each are marked by arrows the exact positions of the instrumental stations and of important peaks. The care taken to secure future identification of the exact sites is characteristic of the attention to detail which is so marked a feature of every part of the work in this expedition.

Chapter II. Barometers and Hypsometers for Altitude Determinations.—

Captain Alessio discusses the application of Laplace's formula for deducing the difference of altitude between two stations, and expresses a decided preference for the modification adopted in the International Meteorological Tables of 1890, as compared with that adopted by Angot in the *Instructions Météorologiques* of 1903.

Five mercurial barometers travelled with the expedition, and a sixth was brought out later by Prof. Alessandri, who actually carried it himself during the whole journey! The most elaborate precautions were taken in the packing and transport of these instruments, yet only the sixth actually returned safe to Italy. Two Fuess hypsometers, specially made and rigorously tested, were also included in the equipment, in the first instance merely for the purpose of studying their behaviour under extreme conditions. A most exhaustive series of comparisons between the barometric and the hypsometric results (pp. 362–372), however, greatly impressed Captain Alessio and caused him to set a high value on the hypsometer, especially in view of its portability and the small risk of damage. He therefore formulates certain important conclusions: (1) that the accidental error in reading a hypsometer is negligible as compared with the accidental errors in reading a barometer for determinations of atmospheric pressure; (2) that the correction to a hypsometer is a function of the prevailing low pressure and of the prevailing temperature, and tends to increase *positively* with the diminution of the prevailing pressure and with the increase of the prevailing temperature; (3) that when, and only when, it becomes possible to ascertain the exact effect on the thermometers of these factors (long-continued low pressure and great variations of temperature), then a determination of atmospheric pressure by a fully standardized hypsometer will be of the same order of accuracy as that by a mercurial barometer of the best type, observed under the most favourable conditions.

At the end of the discussion (p. 373), Captain Alessio suggests that some mountain observatory, such as that on Monte Rosa, might usefully undertake the study of hypsometer readings under varying conditions, and he expresses his opinion that this might probably lead to "the triumph of the hypsometer over the barometer"! The attention to detail in the above comparison and in the investigation of the effect of the other variables (temperature and humidity) on the determination of altitude makes the whole inquiry a notable example of physical research, often under almost Arctic conditions.

Chapter III. Geodetic and Topographical Operations.—Signor G. A. Spranger here gives an account of the triangulation carried out by Major H. Wood, R.E., and himself, with the assistance of Jamna Pershad and Shib Lal, two experienced Indian surveyors lent by the Survey Department of India.

Heavy snowstorms in the pass behind Leh and the gorge-like valley of the upper Shyok greatly hampered the plane-table traverse and the recognition of fixed points; and, after arrival on the Depsang Plain, the weather was so bad that it was decided to measure a base and to start an independent triangulation resting on astronomically observed latitudes and azimuths. Fortunately the weather improved shortly afterwards, and it became possible to observe a great many peaks, including K_2 and one of the Teram Kangri peaks and others fixed by the Indian Triangulation. Plate XLIX. shows the chart of the Depsang triangulation: it is the framework for the fine map given in the 'Storia' of the De Filippi Expedition. As will be seen, the triangulation is divided into two parts by a west and east line through the Karakoram Pass,

and that therefore the connection between the two parts is rather weak. This weakness, however, was greatly diminished when it became possible to check the whole work by fixing the ultimate station towards the north by means of rays to the Gasherbrum peaks and to 12/52 E. The very unfavourable weather rendered the work extremely difficult, and the fine results achieved reflect great credit on all concerned.

Chapter IV. Photographic Work.—Major C. Antilli, of the Italian Engineers, the official photographer, gives a concise account of the outfit (p. 409). Films and film-packs were used throughout and proved eminently satisfactory, though special precautions were needed during very dry weather owing to the risk of electrification, and also whenever the moon was shining on snow surfaces. Pure water for developing and washing was often a very real difficulty. In addition to a large number of photographs taken by private cameras, 4000 official exposures were made and some 2600 negatives were catalogued, besides several hundred metres of cinematograph films of characteristic scenes and costumes in Baltistan and of the religious masked dances in Ladakh. The splendid plates which adorn this and the other volumes * so far published are in themselves sufficient testimony to the excellence of the photographic work.

B. B. D.

REVIEWS

EUROPE

Majorca.— Henry C. Shelley. London: Methuen & Co. 1926. 9 × 5½, pp. xxiii. + 283. *One Map.* 10s. 6d. net.

A PLEASANTLY written book which should be in the hands of every intelligent British and American visitor to this delightful island. The first quarter of the volume gives a good account of the history from the earliest times up to the Catalan revolt of 1640 and the war of the Spanish Succession. Full use has been made of Foster's translation of the original Chronicle of James of Aragon, surnamed the Conqueror, who drove out the Moors in 1229, as well as of the standard works of Piferrer and Quadrado, Maria Bover, and other historians. Then follows an excellent chapter on Palma, the author dwelling lovingly and judiciously on the architectural details and other beauties of that charming old capital, once the pride and glory of merchant princes of the Mediterranean. The mediæval Almudaina, which incorporates much of the earlier palace of the Moorish kings, the magnificent cathedral founded by the first Christian king, and the famous fifteenth-century Lonja, or Exchange, are all well described. Readers of the book will cordially endorse the author's regret that so little use is now made of the third of these noble buildings. A few mediæval retablos and some indifferent modern paintings are practically all that is contained in this so-called "museum." And yet close by, hidden away in an almost inaccessible corner of the Bishop's Palace, "practically unknown to the visitor," is an extensive and rich storehouse of archæological treasures, Iberian, Carthaginian, Greek, Roman, Moorish, and Mediæval, crying out for such a setting as the glorious old Lonja would afford. Also, as

* The following reviews have already appeared in the *Journal*: Series II. vol. 1, 'Storia' or General Report, 66, p. 254; vol. 3, 'Glaciology,' 63, p. 243; vols. 8 and 9, in 68, p. 257. In the footnote to the last on p. 257 the following corrections should be made: line 1, for "fourteen vols." read "thirteen"; line 5, for 43 read 63; line 6, for 46 read 66.

the author says, "there is no more suitable place than the Lonja for a small but representative collection of specimens of the beautiful old arts and crafts of the island."

After describing various other interesting buildings in Palma and narrating exciting incidents of town life in the heyday of the city's prosperity, the author takes his readers out into the country. The well-known tourist resorts of Soller and Valldemosa (with memories of Chopin and George Sand), and the beautiful scenery of the northern mountains with the famous monastery of Lluch, come in for their due share of praise. Many of the smaller and less known towns of the central, southern, and eastern parts of the islands (Inca, Muro, Felanitz, and others) are dealt with in turn. The ancient town of Arta is briefly described, but its still more ancient prehistoric ancestor, a few hundred yards away, with its massive walls and Cyclopean gateway of three huge monoliths, appears to have escaped the author's notice.

At Alcudia there appears to have been some little confusion in the author's mind between a modern bull ring, an amphitheatre, and a Greco-Roman theatre. The last named, which, as he says, is "in a field about a mile outside the city," is no amphitheatre, although it is but fair to say that the owner and most of the natives commonly call it by that name. Nor can the reviewer assent to the startling suggestion (p. 195) that "certain cave-like apartments (which are really typical examples of the prehistoric cave dwellings so common in the Balearic isles) "must have formed part of the retiring rooms of the structure" (the theatre), which is obviously of much later date: the theatre has been built over and into the earlier dwellings.

A good chapter by Mr. Ivan Lake on the picturesque range of mountains which form the north-western boundary of the island, and then a short and sympathetic chapter on the people and their ways, bring the volume to a close. The book is well got up and profusely illustrated with excellent photographs.

The map does not bring out the great contrast between the mountains and the central, nearly flat plain. It is also not quite up to date; for instance, the railway by which the reviewer, as long ago as the winter of 1923-4, travelled from Manacor to Arta, is not shown.

J. B.

Etudes sur les instruments Géodésiques et sur les résultats de la triangulation cadastrale effectuée dans l'Aisne, 1924 et 1925.— L'Ingénieur en chef Roussilhe, Directeur du Service d'Etudes pour la Réfection du Cadastre, Paris, le 10 Mai 1926.

This report, upon the results of the triangulation for the revision of the cadastral maps of the Aisne, and upon the instruments used for the purpose, is made up of ten separate roneoed pamphlets in a portfolio.

Colonel Roussilhe's name is well known to English surveyors. He commanded a French Groupe de Canvas de Tir (or Field Survey Company) in the war. He was a great believer in the rectifying camera for mapping from air photographs at that time, and since then has used this method with success in the cadastral mapping of the old war area; and lastly he was an energetic and helpful member of the international geodetic Conference at Madrid. His particular contributions on the stereographic projection and on the semigraphic method will be remembered with interest.

The cadastral triangulation which he organized for the Aisne is not what one commonly visualizes in that connection. It includes, for example, several first-order points and many of the second order. The triangular errors are about 0.8 second for the first order and some 3" or so for both second and third orders. Linear errors are assessed at 1/70,000 for secondary and 1/30,000

for tertiary. A first-order triangulation, to swallow whole such work as this, must indeed be good.

Perhaps the most interesting fact about the triangulation is that it is computed directly in the coordinates of the stereographic projection. Computation is carried to terms of the sixth order, and it is claimed that, inclusive of residual projection error, no point is likely to be more than a decimetre out of position. The terms involved include the even powers of x and the odd powers of y , and the last term of x can mean but little unless the origin is very remote.

Field work and computation for some 2300 square miles, resulting in one point for each 10 square miles, were completed by a staff of nine in seven months.

By far the larger part of the letterpress is devoted to a description of the theodolites and azimuthal circles (theodolites without vertical arcs) made by M. Chasselon for the Service d'Etudes. These instruments were designed to give a "bearing" error of 10 centesimal seconds (about 3"). The horizontal arcs are 220 mm. (or in some cases 180 mm.), and the following are points from the specification :

Two micrometer microscopes per arc.

A movable wire in the reticule.

Silvered arcs divided to 0.20 grades.

Micrometer microscopes to allow of two revolutions per division (1 turn per decigrade).

Direct reading to the milligrade.

Telescope focal length 32 cms.

Magnification, alternatively 20 and 30.

Objective 4 cms.

Weight : (instrument complete) 13 kgs. ; (box) 12½ kgs. Total, 25½ kgs.

The instruments are then of the sort to which we are accustomed, and in no way resemble the Zeiss or Wild models. They are light for their size, but not as light as one could hope for.

A very careful and interesting analysis of angular measurement by the various models, collectively and individually, is given. They seem to have stood up well to the field work and to have fulfilled expectations. Those particularly interested in instrumental design will be well advised to study the reports.

H. S. L. W.

A Dawdle in France.— Inglis Sheldon-Williams. London : A. & C. Black, Ltd. 1926. 8½ × 5½, pp. viii. + 264. *Sixteen Full-page and Fifty Smaller Illustrations from Drawings by the Author, and a Map.* 7s. 6d. *net.*

We have had Wanderers, Wayfarers, and Vagabonds, and now we have a Dawdler. This opens up an alarming prospect of Loafers, Loiterers, and Loungers, and it is questionable whether there is room for all these volumes, much as France has to show us. There seems to be little justification for the present work, which purports to describe a cycling and sketching tour from Dieppe to Mont Cenis, but often wanders off into idle prattle about things in general and nothing in particular. There may be readers who will appreciate the author's frantic efforts to maintain a bright and chatty (not to say slangy) style of writing ; but, to be candid, "we are not amused."

A Wayfarer in Sweden.— Frederic Whyte. London : Methuen & Co. 1926. 9 × 6, pp. xvi. + 207. *Seventeen Illustrations and a Map.* 7s. 6d. *net.*

Although this wayfarer writes in the style and from the point of view of a journalist, his book shows considerable observation and understanding of

modern urban Sweden. Persons and instances are happily chosen, nationalist writers like Selma Lagerlöf and Carl Laurin are often and aptly quoted, and in the chapters "Swedes and English" and "Carl Larsson and his Swedish Home" there is both breadth of view and humour.

The itinerary followed is mainly along familiar routes—to Göteborg, thence by the Canal to Vadstena and Stockholm, and on to Gotland; but the author makes excursions to Lysekil, Båstad, Helsingborg, Porjus, and Kiruna, and in his chapters on Swedish art and literature refers to many notable places. It is curious that neither Upsala nor the province of Skåne—both so historic and, in their different ways, so representative of Sweden—is described at all, and only mentioned incidentally. Lund is not even mentioned.

The author provides a background to his pictures with a thoughtful chapter on "Sweden's Three Greatest Kings"—Gustavus Vasa, Gustavus Adolphus, and Charles XII.—and two chapters on Bulstrode Whitelocke's embassy to Queen Christina in 1653-54. The space given to Whitelocke's narrative here is perhaps disproportionately great, but it is a very interesting historical document which Mr. Whyte has done well to bring to the notice of the general reader.

The author's wife, who is a Swede, has contributed a chapter on Dalecarlia, as well as passages—put, quite unnecessarily, in inverted commas—in other chapters. The photographs, some of them from pictures by Swedish artists, are good, and the book has an index. The map, which is printed on the inside of the cover, is not good enough.

E. L.

Wanderdünen Pommerns.—Dr. Wilhelm Hartnack. Greifswald: Julius Abel G. m. b. H. 1925. 9½ × 6¼, pp. vi. + 112. *Twenty-three Text Figures, one Plate.*

This monograph deals with the dunes of the Hinter-Pomeranian coast. The author first gives a general account of the area—a typical flat coast whose history is intimately connected with the Baltic. The general form of the coast (*Rohbau*) owes its origin to the *Littorina* phase which affected the Baltic region.

After criticisms of earlier work the author considers the effects of erosion by various agencies on a line of dunes (*Vordüne*). The hollows (*Windmulden*) formed in this as the result of erosion lead to the development of new forms—*Haldendünen* and *Parabeldünen*. The *Haldendüne* is a crescent-shaped terminal dune formed in an erosion hollow: it is, apparently, the equivalent of the *pourrière* of the Picardy dunes (see Briquet, *Ann. de Geog.*, 32, 1923, p. 390). The *Parabeldüne* is a further development of the *Haldendüne*: the oblique impact of the prevalent winds on this coast causes the *Windmulden* to run slantwise to the general line of dunes, in such a way that they extend to the east-north-east, or nearly parallel with the main dune belt, rather than at right angles to it.

The author's main object was to examine and explain on a genetic basis the various phases passed through by a moving dune. The Hinter-Pomeranian coast is rather unusual in its situation. In the majority of the other European dune areas (exception being made of Flanders, which, the author says, no longer possesses moving dunes) the direction of the prevalent wind is the main factor in the formation of dunes. But on the Pomeranian coast the wind approaches the coast obliquely, thus producing certain special phenomena. This is particularly noticeable if the Pomeranian dune areas are compared with the dunes on the Kurische Nehrung.

The monograph is very well produced and illustrated by some instructive photographs and diagrams. A very useful bibliography is given, containing many references to other work on coastal dunes, including that of English and French, as well as German, authors. It is a pity a general map of the area on a fairly large scale is not given. Further, a summary of conclusions would be a great help.

J. A. S.

ASIA

Chinese Central Asia.— C. P. Skrine. With an Introduction by Sir Francis Younghusband, K.C.S.I. London: Methuen & Co. 1926. 9 × 5½, pp. xvi. + 306. *Photographs and Map.* 21s. net.

Among the most delectable countries of Asia is Chinese Turkistan. It is the most distant of all lands from the restless ocean, while, owing mainly to the mighty ranges by which it is encircled, no railway has reached its oases, and the camel, the horse, the mule, and the donkey remain the leisurely means of transport. Its historical interest is great, for through the length of the land ran the celebrated Silk Route, along which intercourse between China, Persia, and the Roman Empire was conducted, with a side route leading to India. Fortunately for the country, owing to the scanty rainfall and the consequent lack of grazing, the great hordes which swept westwards across Asia, devastating the country and massacring the sedentary populations, generally avoided Chinese Turkistan, which thus remained relatively unharmed and unchanged.

It is a vast country, so vast that it would take many years to travel all over it, while for the explorer, the archæologist, and the anthropologist there is still work to be done in a climate that is bracing and among a friendly people.

Mr. Skrine was appointed Consul-General in Chinese Turkistan, and, accompanied by his dauntless wife, started off from Srinagar in June 1922 on a fruitful journey of two and a quarter years. The travellers had already gained experience in the hard frontier school, having spent over a year in Sarhad, the wildest district in Persia, while Mr. Skrine had previously served as Consul in remote Kerman. His knowledge of Persian was especially valuable in a land where the most eastern group of Persian-speaking Aryans dwell, and where the civilization and art are alike deeply affected by historical Iran.

The journey to Gilgit is briefly described, but Hunza arouses enthusiasm, which results in a delightful description of its beauties on p. 25. After trying marches through the heart of the Karakoram, the boundary of the Indian Empire is reached at grim Mintaka, the "Pass of a Thousand Ibex," which rises to 15,600 feet. On its northern slope the Consul-General was welcomed by representatives of the Aryans of Sariqol, who are subjects of China, but pay tithes to their religious chief, H.H. the Aga Khan of Bombay, as also do the inhabitants of Hunza. From Tashqurghan, the chief village of Sariqol, the party gradually descended to the immense "oasis-fringed desert, which stretches for 2000 miles from Kashgar to the mountains of Inner Mongolia."

After a ceremonious reception at Kashgar, the Skrines threw themselves with enthusiasm into their respective duties. The consulate, which, thanks to the energy of Sir George Macartney, occupies the best site outside the city, is set in a terraced garden on the low cliffs which bound the valley of the Tümen Su. Its delights are vividly described on p. 56. Both the Skrines rapidly learnt Turki, and Mrs. Skrine made friends among the women and children. One visit was paid to the mother of a high official, "who might have stepped straight out of a fairy story. She looks about a hundred and fifty, wears a black silk handkerchief tied round her head like a pirate, and owns an enormous

woolly black cat, which adores her and sits all the time licking her hands and face."

There was plenty to do at Kashgar in the way of official work. At the same time it was essential to tour as much as possible, and about one-half of the Consul-General's time was spent on the road. With autumn came the touring season, which depended mainly on the fact that the rivers were easier to ford than at other seasons, while the snow had not yet blocked the passes. Even so, the country away from the plains is perhaps as difficult as any in Asia. To the south of Kashgar lies a remarkable Alpine area which, owing to its extreme inaccessibility except during a few weeks in the year, had remained unexplored, although within sight of Kashgar on the rare occasions when the atmosphere is clear. Mr. Skrine has the distinction of being the first traveller to explore and survey these unknown and probably inaccessible peaks. The chief results of his three separate journeys consist in the proof that there are two main peaks of Qungur, each of which exceeds 25,000 feet, with the lower range termed Shiwakte. It was also proved that the vegetation, including forests of firs, is akin to that of the distant Tian Shan rather than to that of the relatively neighbouring Karakoram system (*vide* "The Alps of Qungur," by C. P. Skrine, *Geogr. Journ.*, 66, November 1925).

Among the travellers' discoveries was a "Happy Valley," which served as a base for many arduous climbs: "In this secluded Paradise of forest and river, of towering crag and pale green hanging glacier, of woodland glade and lush meadow, of natural rock-gardens filled with a hundred different kinds of Alpine flower, we spent a never-to-be-forgotten holiday." From this elysium Mr. Skrine climbed with much difficulty to a col, "and then," he writes, "I was rewarded by the finest mountain view I have ever seen. Right opposite me in the west, only 5 or 6 miles away, stood a group of glorious mountains like colossal icebergs glittering in the sun, their sides clothed with hanging glaciers thousands of feet high. It was my first near view of the mysterious and inaccessible Shiwakte, and the sheer beauty of its four 20,000-foot peaks took my breath away."

In the level plain tours were made to Yarkand, the centre of the trade with India, to Khotan, the Kingdom of Jade, and to Keriya, the *Ultima Thule* of Chinese Turkistan. From its eastern gate, a desert 900 miles wide separates this frontier town from the borders of Kansu, a fact emphasizing the vastness of the Heart of Asia. The northern side of the province was visited in the second year, and this tour, like the others, yielded a rich harvest.

To sum up, this book is of outstanding merit, the work of real travellers. Information is given on many subjects by an author who is not only deeply read, but describes what he sees and what he thinks in a masterly manner. It also shows the great advantage of the assistance that can be given by a highly gifted lady, both in the collection of information and in creating a friendly atmosphere, which is essential to success. Finally, the illustrations are superb.

P. M. S.

Among the Kara-Korum Glaciers.— Jenny Visser-Hooft. With contributions by Ph. C. Visser. London: Edward Arnold & Co. 1926. 9 × 6; pp. xii. + 304. *Map and Illustrations.* 21s. net.

Mrs. Visser-Hooft is to be sincerely congratulated on her charming and cultured account of the expedition which she made with her husband to the Hunza Karakoram in 1925. The narrative is well illustrated, and is a model of what a travel story designed for the public should be: "perspicuous, accurate, appropriate and persuasive," epithets which Sir Arthur Quiller-Couch adopted

for the hallmark of English writing. It is indeed a real pleasure to see our language handled with such grace and simplicity.

The reader cannot fail to feel himself drawn to the unknown fastnesses of the Karakoram, to share with the travellers their anticipations, and to enjoy the same moments of wonder and surprise. He must be enchanted by the beautiful descriptions of scenery, especially where the savage background has been so skilfully and so truthfully tamed by such a mountain worshipper. The vivid sympathy and understanding revealed in many of the passages dealing with the virtues and shortcomings of the native porters are themselves a tribute to the authoress. In the brief compass of Mr. Visser's lecture to us on February 22 last year, which was published in the December *Journal*, it was natural that stress should be laid on the actual geographical discoveries; it was not possible then to convey the full charm of the short Alpine summer, or the beauty of the flower-strewn moraine valleys; nor was it feasible in the time to leaven entirely the fierce landscapes on the screen—in spite of the excellence of the photographs—with the elusive atmosphere of the Karakoram. These important discoveries need not be recalled here; but in addition to a very good account of them, Mrs. Visser-Hooft has succeeded in capturing the true atmosphere. Rock and ice, sunshine and storm, laughter and trouble—six main elements of the Karakoram—have been interwoven in excellent harmony. And many of the passages, notably those dealing with the autumn flowers and colouring, are far more than a great joy to read.

Those who can for a moment cast off the spell of Mrs. Visser-Hooft's beautiful word pictures, and who wish to follow the topographical features and glacier discoveries of the expedition more closely, will regret that the map reproduced at the end is quite insufficient for the purpose. The publishers would have been better advised if they had included the one which appeared with Mr. Visser's paper in the December *Geographical Journal*. The index is also incomplete.

A few minor mistakes might be mentioned in the interests of absolute accuracy; these also are probably not the fault of Mrs. Visser-Hooft. On p. 223, the Inilchek glacier of the Tien Shan has been printed *Tuylchek*; and as regards the list of long glaciers, it may be noted that the Biafo, 37 miles long, is probably a shade longer than the Batura. On p. 160 Mrs. Visser-Hooft's explanation of "Malangi Dias" is doubtless correct; but on p. 158 there is a slight misconception. The map supplied to the Vissers was incorrect in showing the Malangutti glacier curving right round "Malangi Dias," from a point due south of that peak. This inaccuracy was not derived from any map or statement by General Cockerill, but was due to an error of map compilation, made in attempting to incorporate the later survey of the Hispar glacier by the Workmans, which has since been found to be misplaced in longitude. Sir George Cockerill expected that the head of the Malangutti glacier would be found south of "Malangi Dias" in latitude, though not in position, and a study of his paper read before the Society will show that he expected the great peak would be found to lie on the watershed at the head of the Kungyang or Lak glacier, where the Vissers have now shown it to be. On the same page, the height of this peak is given as 25,668 feet, and as this appears also in Mr. Visser's lecture and on his map in the *Journal*, it may be assumed that this height was supplied to them. In the original records of the Indo-Russian Link, and in the latest triangulation pamphlets of the Survey of India, the correct height is given as 25,868 feet.

The scientific results of the expedition, apart from the purely geographical

discoveries, are briefly summarized in the concluding chapter. When they have been fully worked out they will be considerable, and we hope to have an account of them in English. This is not the first expedition made by these explorers to the Karakoram. The reader will lay down Mrs. Visser-Hooft's book with the hope that it will not be the last, and that there will be as much to be told—and told as gracefully—when they return. K. M.

An Unexplored Pass.— Capt. B. K. Featherstone. With an Introduction by General the Hon. C. G. Bruce. London: Hutchinson & Co. [1926.] 9½ × 6, pp. 288. *Map and Illustrations.* 18s. net.

This book is the best possible testimony to the need of a Club for the Himalaya corresponding to the Alpine Club for the Swiss Alps. Here is an "Unexplored Pass" easily accessible from India, and sticking out on the map inviting exploration, and yet, for nearly forty years since the last attempt to reach it was made, no one had gone near it till Captain Featherstone had the enterprise to make the venture. But Captain Featherstone, like his predecessors, Schlagentweit, Godwin Austin, and myself, had no Alpine training or equipment. With such training and equipment there is no reason to suppose that the pass would not be crossed with comparative ease.

It was in use in former days. The guide I employed in 1887 had crossed it twenty-five years before. Since then much ice had accumulated, and we had to revert to the "old" Mustagh Pass, which we crossed and which the German Alpinist Ferber also ascended from the Indian side some fifteen years later. When, after crossing the Old (or Eastern) Mustagh Pass, I went back from Askole to see what the New (or Western) Mustagh Pass was like I was stopped by an ice-fall at about the same point where Captain Featherstone was stopped. And, being at the end of a long journey from Peking and having satisfied myself that there was no chance of a Russian army coming by that way, I did not stop to explore further.

But Captain Featherstone is quite right in recommending that an attempt should be made to cross over the main range by the New Mustagh and come back by the Old Pass. And I agree with him that the coolies necessary for this should be recruited elsewhere than from Askole. As on the Everest Expeditions, men should be specially enlisted, paid, clothed, and equipped for the purpose. And the European leaders should have Alpine training.

Government cannot be expected to initiate, finance, and organize the expedition; nor can single individuals be expected to possess the necessary money. The men who may have the training and experience may not be able to afford the expense. But a club in such cases would be of great service to men like Captain Featherstone, who have the desire to visit unfrequented parts of the Himalaya but need advice and support in order to get value from their efforts. Captain Featherstone in this case did not succeed in getting to the "Unexplored Pass," but he has written an interesting book of the adventures by the way and the peoples whom he met.

FRANCIS YOUNGHUSBAND.

The Riddle of the Tsangpo Gorges.— F. Kingdon Ward. London: Edward Arnold & Co. 1926. 9 × 6, pp. xvi. + 328. *Twenty-one Plates and Map.* 21s. net.

The search for drugs, spices, and plants of economic value has urged men to travel throughout the ages, but it is doubtful whether such hazards and privations have been faced before for the avowed purpose of collecting seeds of plants whose claims to enrich the gardens of our homeland lie entirely in their beauty or their rarity. And yet this was the chief objective of Captain

Kingdon Ward and Lord Cawdor, whilst the solving of the riddle of the Tsangpo Gorges, which provides the actual climax of the story as here recounted, was only incidental to the trip.

The author rightly assumes that a certain amount of instruction in geography, both of Tibet in relation to the outside world and of the country itself, is necessary to introduce the reader to the area with which the story more particularly deals. This is, however, lucidly discussed in the first few pages, and then attention is directed to the formidable gorge country of the south-east, where the great rivers of Tibet in their middle courses force the barrier ranges of the Himalaya and flow down to the plains of India and China. Through this gap, some 200 miles wide and situated between the abrupt eastern end of the Himalaya, the mighty Namcha Barwa, and the north-to-south barrier ranges separating Tibet from China, the Indian Monsoon forces its way northwards along the river gorges, drenching the country and favouring forest growth as far as its influence can make itself felt. This is in striking contrast to the same monsoon wind to the west, which is wrung dry on the plateau edge and desiccates the greater part of Tibet.

It was realized that there was no possibility of entering these river gorges from the south, their great depth, unscalable precipitous sides, unnavigable rivers, and tracts of foodless and uninhabited forests prevented such an attempt. The way chosen, therefore, was from Darjeeling over the Sikkim Himalaya at the Nathu La (14,500 feet) and across the great plateau by way of Phari and Gyantse. At the Yamdrok Lake the expedition left the Lhasa road and turned eastwards, striking the Tsangpo at Tsetang at 11,850 feet altitude. No woody plants are encountered on this plateau, where exist only Alpine flowers such as poppies, aconites, primulas, and campanulas. The prolonged period of drought, fierce desiccating winds, and salty soil are too inimical to plant-life.

The second phase of the expedition was the exploration of the Tsangpo Valley from Tsetang eastwards past Tsela Dzong to Tumbatse on the Rong Chu, during which the plateau with its subarctic vegetation was left behind and a temperate Forest vegetation freely encountered. The chapters entitled "A Botanical Reconnaissance," "The Land of the Blue Poppy," "The Paradise of Primulas," give the reader some delightful pen pictures of the wonderful Alpine meadows encountered and of the strenuous work the ardent plant-collector accomplished.

The third phase was the excursions carried out from Tumbatse. June is the month for rhododendrons in Eastern Tibet, and their wealth is admirably described when the travellers crossed the Tsangpo near Pe and worked around the Doshong La and even penetrated to Pemako on the southern aspect of the Himalaya. The wealth of the flora of this province, the perpetual rain and saturated atmosphere, made a vivid impression on the travellers. In the description of this trip the reader gets a definite glimpse of the all-absorbing "Riddle." To the north the Tsangpo flows eastwards at an altitude of 9700 feet, but 25 miles southwards, in a direct line, its continuation, the Dihang, is only 2500 feet above sea-level. The mountains between rise to a height of 25,000 feet. How is this great drop of the river accomplished?

Another excursion from Tumbatse was to the Nam La, about halfway between the Doshong La and the all-dominating Namcha Barwa. The flora proved poorer in species, but the surprise was that these two valleys, only 5 miles apart, contained species peculiar to each.

Yet another excursion was made northwards along the Rong Chu to Tongkyuk Dzong, and then westwards past the lakes along the south of the

Salween Divide through Shoga Dzong to the Atsa Tso at an altitude of 14,938 feet, where General Pereira had passed only two years previously. From an altitude of 18,180 feet on the Band La the "dying glaciers" of the Tsangpo-Salween divide were seen, and an astonishing variety of flowers recorded for such a locality.

Before leaving Tumbatse finally, an intensive seed-collecting campaign was undertaken and preparations made for the final phase of the actual assault on the Tsangpo Gorges.

The story of this culminating stage of the expedition must be read in detail in order to obtain even the slightest appreciation of the difficulties encountered, the dangers escaped and the hardships undergone. There is a thrill in the chapter "The Falls of the Brahmaputra" which holds one throughout, and the reader feels that he himself comes away from the awful thunder of the water in the cavernous gorges and the heavy hanging mist of the waterfalls with the knowledge that one of the few remaining "riddles" of the Earth's surface is at last laid bare. The travellers were prevented by the impassable nature of the defile from following the whole of the middle course of the Tsangpo, and some 5 miles beyond the point to which Bailey penetrated in 1913 they had to cut across a mountain range to Payi. Near here they crossed the river below its confluence with the Po-Tsangpo, doubled back along its northern bank, and so actually saw all except a stretch of some 6 miles.

How the Tsangpo falls at the rate of 132 feet a mile over the last 14 miles of its course, and, after its confluence, falls for another 4 miles at least at nearly 100 feet a mile, was briefly told by Mr. Kingdon Ward in the *Journal* for February 1926; and for further details the reader must be referred to the book itself.

The return journey followed the former trail along the south aspect of the great Salween Divide and then southwards to Tsetang. Bleak discomfort is the prevailing tone, but the travellers were heading for home, and these thoughts served to sustain them in their wanderings across the desolate plateau against the terrible wind until they descended into Bhutan and got into touch with civilization once more at the railhead at Rangiya.

The organizing spirit which made such a journey successful is dominant throughout. Despite the physical privations, often only indicated, the plant collector always keeps the object of his mission to the fore. The story leaves on the reader's mind a vivid impression of the gorgeous Alpine meadows and the all-dominating Namcha Barwa. The fights against nature, the endurance displayed in the gorges, and the bleak return illustrate the dogged perseverance of these intrepid travellers. It is difficult to realize that the author with his facile pen and up-to-date allusions is the leader of the expedition which actually underwent the trials narrated.

There are still two stretches of this mighty river unexplored. Who will complete the picture?
T. F. C.

Aus dem Jemen.— Hermann Burchardts letzte Reise durch Sudarabien.
Bearbeitet von Eugen Mittwoch. Leipzig: Brockhaus. 1926. 11½ × 9,
pp. 74 + 28 pl. *Sketch-map and Illustrations.* [In Arabic and German.]

Hermann Burchardt, who in fulfilment of a self-appointed task had made journeys in both western and eastern Arabia, went to Yemen for the third time in 1909, and after a stay of some duration at Sanaa, passed down the Aden road to Qataba, and thence by Taiz to Mocha. He returned to Taiz accompanied by Signor Benzoni, Italian Consul at Mocha; and the two proceeded to Ibb, whence with a small escort they set out on December 19

for Udain. The party had passed a village, Mashwara, where a Sunday market was in progress, and descended into the Wadi ed-Dor, when it was set upon, at about an hour's distance from Udain, by a band armed with stones. Burchardt and the Consul were killed, and their bodies were buried on the spot. Two of the escorting soldiers seem to have been wounded, but what, if anything, happened to the servants is not said. Plunder does not seem to have been the motive, for the property of the murdered men was handed over at once to the local administration. Thence it was recovered by a commission sent up by the Italian Government, which exhumed the bodies. It looks as if the attack had been prompted by simple hostility to strangers or by fanaticism. If by the latter, it is interesting to note that a few months previously Burchardt had been described as a Moslem in a letter from the Imam Yahya.

He posted up his notebook almost as far as the point where he met his end. Some brief entries in this are given by way of notes to the main narrative of the whole journey, now published by Dr. Eugen Mittwoch. The author of that narrative is, however, not Burchardt, but his Yemenite secretary, one Ahmad ibn Muhammad al-Garadi, who, at the instance of a well-known Italian resident at Sanaa, Signor Giuseppe Caprotti, wrote out two copies. One was sent to Burchardt's representatives at Berlin, the other to the Ambrosian Library at Milan. They are apparently not quite identical; but Dr. Mittwoch conflates them into one Arabic text, to which he appends a translation and notes, and also a collection of examples of the Sanaa dialect, compiled from Burchardt's papers.

The Secretary's narrative (he was not with the party when it was attacked, having been left ill with fever at Ibb) is, as one would expect, rather a jejune affair, confined to little more than dates, distances, names, and a record of the photographs taken by his master. Here and there a fact about buildings occurs, and more rarely a note on native customs and manners. But, in its earlier part at any rate, the narrative is so meticulous about recording names of villages, valleys, and mountains, as well as journey hours, that it should be of considerable assistance to cartographers of south-western Yemen. Though none of the tracks traversed was quite new (except perhaps the last from Ibb towards Udain), we have no such detailed knowledge of either the Aden or the Mocha tracks as would justify neglect of a new and reliable road-book. No map beyond a mere sketch is included in the present publication, but, on the other hand, it does include some sixty well-reproduced photographs of Yemenite types, life, buildings, and landscapes.

Burchardt's fate recalls closely that which befell Seetzen in 1810 in the same district of south-western Yemen. The former had made, like his predecessor, the mistake of returning on his tracks. The town, Udain, for which he was making, was noteworthy during the Great War for its insubordination towards the Turco-Imamic *régime*. Perhaps, therefore, some peculiarly vigorous tradition of chauvinistic independence is preserved there. At any rate, there is no record of a European visit to the place. D. G. H.

An Immigrant in Japan.— T. Geoffrey. London: T. Werner Laurie. 1926. 8½ × 6, pp. viii. + 284. *Illustrations*. 12s. 6d. net.

This is a book written in characteristic American style and from a point of view frankly Transatlantic. While purporting to deal mainly with the "Japan off the beaten tracks," it is really almost entirely occupied with the pre-earthquake experiences, domestic and local, of a lady whose husband was employed in an American business firm in Yokohama though dwelling for the most part

in a seaside suburb of that great seaport, little more than a few minutes' drive away. The frequent claims of the authoress to a knowledge of the Japanese language are difficult to reconcile with the numerous mistakes scattered throughout the text. In her descriptions of the ordinary life of a far-eastern "Treaty port" the writer dwells unduly upon its seamy side. She also gives a very frank description of the atrocious conduct of her American companions at a wayside village in the chapter entitled "The old gentleman of Jimbohara." Such incidents serve to account for the unpleasant reputation so often left behind in such places by the peculiarly objectionable type of tourist here described.

The claim of the authoress to the "distinction of being the first foreign woman" to climb the famous sacred peak of Ōyama is as absurd as it is inaccurate. At least ten years earlier a well-known English lady mountaineer had made the ascent in the company of the writer of this review. There are a number of interesting illustrations throughout the book, though we could well have been spared the frontispiece entitled "America disturbs Buddha's meditations." There is neither map nor index, and so numerous are the peculiar "Americanisms" in the text that to the uninitiated English reader a glossary would be of considerable value.

W. W.

AFRICA

La Actuación de España en Marruecos.— "Juan de España." Madrid: Imprenta de Ramona Velasco. 1926. 8½ × 6½, pp. 369. *Illustrations.*

Under the pseudonym of "Juan de España" a Spanish journalist writes vividly, as an eye-witness, of the epic events of September 1925 in Alhucemas Bay. The swift march of military operations in that month obscured to the casual world the careful work of administrative and diplomatic preparation of which these operations were the crown, but the adequate description given here shows the facts in their true relations. For the first time a full account is published of the administrative changes which concentrated in a single bureau in Madrid the direction of Moroccan affairs and so made possible unity of conception and rapidity of execution, the former being greatly extended in sphere by the diplomatically-prepared cooperation with France. A panoramic view of Alhucemas Bay and a long extract from the Operation Orders for the landing add to the interest of this section of the book.

The moment has appeared suitable to the author to proceed to a review of the whole work of Spain in her North Moroccan zone, and this review is welcome as a useful supplement, based on the most recent statistics, to the only description of the zone available in English—His Excellency the Spanish Ambassador's communication to the Society in February 1920.

Nothing seems to check the rapid growth of Melilla, in 1900 a small town of 4000 inhabitants gathered under the shelter of the fortress, to-day a city of some 52,500 inhabitants spread out over the area of Spanish sovereignty. This sensational increase does not appear to be explained fully by the mineral exports (about three million metric tons in the twelve years from 1914 to 1925) and the importance of the hinterland alone; Huelva, in Spain, has a population of under 40,000, although it has exported on occasions nearly as much ore in one year as Melilla in twelve, while the attraction of the hinterland cannot as yet be fully operative. The existence of the military base at Melilla has perhaps played a considerable part in its growth, and "Juan de España" is probably correct therefore in supposing that the town has already reached the period of maturity. Quick growth in the near future appears to him to be

more likely in the west of the zone, where Ceuta is rapidly preparing harbour improvements against the day when improved communications with the interior, added to the great natural advantages of the site, may enable her to compete successfully as a commercial port with her rivals on the Straits. A scheme has already been adopted for connecting Ceuta with Alcazar by building a new railway to link up, at one end with the existing Ceuta-Tetuan line, at the other end with the Tangier-Fez line at Biban, after the main watershed of the Yebala has been crossed at the Fondak de Ain Yedida.

The effect of these improvements and of those at Larache and elsewhere in diverting or increasing the current of foreign trade remains to be seen; the significant fact for the British reader at present is the serious decline of this country's trade with North Morocco. In 1914 Great Britain supplied over 30 per cent. of the imports to the Spanish zone and took about 12 per cent. of the exports, while in 1924 the corresponding percentages were approximately 9 and 8.

Behind the more obvious military and engineering work undertaken by Spain in her zone, a quieter and perhaps, in the long run, more important work of re-afforestation and agricultural education has also been going steadily forward. Experimental stations have been set up to test the resistance of trees and plants to the climatic conditions; nurseries at Larache and on the Rio Martín supply young trees for the fixation of the large dune-tracts and for the repopulation of the deforested areas; the important experimental work in Dry-Farming and in Sub-tropical Agriculture in general, carried on at official stations in Spain, has also been extended to the protectorate. No one who knows the excellent work of the officers of the Agronomic Service can have doubts of the ultimate effect of their influence in Morocco.

It should be mentioned that "*La Actuación de España en Marruecos*" is available also in English and French translations. R. A.

An African Eldorado : The Belgian Congo.— T. Alexander Barns. With an Introduction by Sir Louis Franck. London: Methuen & Co. 1926. 9 x 6, pp. xv. + 229. *Maps and Illustrations.* 15s. net.

In 1909 the administration of the vast territory of the Congo Free State, over 900,000 square miles, containing more than 12,000,000 peoples, passed from the sovereign to the Belgian State, giving the Belgian Government the opportunity to repair an evil it had wrongly tolerated too long, said M. Emil Vanderwelde, the Belgian statesman. Four years later, in 1913, the change in policy was inaugurated to the satisfaction of the Congo reformers. Then came the Great War. As a result of the Treaty of Versailles Belgium obtained a mandate for the Ruanda and Urundi districts, and became responsible for the well-being of an additional 5,000,000 peoples.

The Belgian Congo has great natural advantages. Over 10,000 miles of navigable waterways intersect its rich fertile soils, which produce a variety of products in great demand by the more advanced peoples of the world—rubber, oils, coffee, cocoa, sugar, rice, sisal-hemp, cotton—and which support countless herds of cattle. The rivers themselves abound in edible varieties of fish. The ridges of the Congo basin contain mineral wealth in abundance. Gold is obtained in the north from the Kilo and Moto mines; copper from the malachite hills of Katanga—the richest copper fields in the world; diamonds from Kasai; and the radium obtained from the uranium ores of Katanga and Chinkolobwe gives Belgium a virtual monopoly of this unpriceable metal.

The development of the Congo basin proceeds apace. According to all

accounts the administration of the territory bears favourable comparison with that of neighbouring British territories. But nothing appears to have been done for the mandated territory of Ruanda and Urundi. The physical barrier of the Great Rift hampers all efforts to bring this populous district within the Congo economic scheme, showing clearly the inconvenience of the present boundary which separates it from its natural outlet through Tanganyika.

The vast unrealized mineral wealth, the potential agricultural wealth in crops and domestic stock, leads Mr. Barns to describe the Belgian Congo as "An African Eldorado" to which all young Europeans in search of fortune should turn their eyes. For the young fortune hunter this volume should be an inspiration. But this is the least attractive aspect from which to regard it, and Mr. Barns does himself and his art a disservice by the descriptive paragraph on the cover. It may be true that there will be a quick and lucrative return on capital invested in the Congo, but there are far better reasons for the presence of white men in the country. They can emulate "les pères blancs" and other devoted missionaries who, by their works and their methods, have brought real civilization to the African native, be he pigmy or Watusi giant, and have given a necessary lead to government, a lead which is now being followed assiduously.

In this wonderful land, parts of which are exceedingly beautiful, no part of which is without abiding interest, white men can assist the natives to traverse centuries of time in a few years. They can be liberators, if they will, in the best sense of the word, assisting the natives to preserve all that is valuable in their own culture while imbibing all that is best in ours. But to do this they must understand the natives.

Those who wish to understand the African peoples, to appreciate the difficulties of the white settler, to realize the tremendous battle which man is ever waging in the tropics against human, animal, and plant diseases, to capture the environment and to enjoy its grandeur and its beauties, should read this volume.

A. G. C.

Letters from the Gold Coast.— H.H. Princess Marie Louise. London: Methuen. 1926. 9 × 6, pp. viii. + 240. *Illustrations and Sketch-map.* 16s. net.

This volume contains some of the best letters from a colony we have ever had the pleasure of reading. The minutiae of tribal and administrative problems are perhaps recorded in rather too great detail for a reader without direct acquaintance with the Gold Coast, but the account which the letters give of Princess Marie Louise's protracted tour of the country is none the less one which can be followed with the greatest interest by the general public. To those who live in the country the book will prove how deeply appreciative Her Highness and her correspondent were of everything that happens there. The numerous excursions into ethnological and archæological matters are, moreover, worthy the attention of the learned; we have often had occasion to speculate upon the amount of good material that has been neglected by students conducting their researches only into obviously scientific places. We cannot here do more than merely refer them to the stories of Ananse the Spider (pp. 130, 146, and 197). No one could fail to be touched by the very gracious acts of the author through her tour, and especially by the incident connected with the medal ribbon of ex-soldier Bassana Grunshi. But one aspect of the book is commendable above all others, namely the unstinted, but only merited, admiration expressed for the colonial civil servant and for his perhaps even more wonderful wife. Is it to the former or to the latter, or haply to both, that in addition to

our Empire we owe that strange sense of the fitting and dramatic which come as such a surprise to the more theatrical foreigner educated to believe us an undemonstrative nation? We wonder whose idea it was, that night after the ball at Kumasi when Princess Marie Louise was leaving the north on her way home, to post a chain of buglers in the bush along the railway line, successively to sound the "Hausa Farewell" as the train bore her away from Ashanti.

F. R. R.

AMERICA

Ancient Cities and Modern Tribes.— Thomas Gann. London: Duckworth & Co., Ltd. 9 × 5½, pp. 256. *Illustrations.* 21s. net.

In the present volume Dr. Gann continues the story of explorations in the area of ruined Maya cities, with which he has already dealt in two previous books; the work of 1926 is recorded here, with no less zest than before. The lover of books of archæological discovery will take up this work as the continuation of a serial story of adventure.

Dr. Gann has, as a matter of fact, something new to relate, in addition to his thoroughly entertaining description of a visit to the fine site of Ichpaatun, on Chetumal Bay, and to the "Cave of Flowers," Loltun, in Yucatan. The accounts of both of these journeys make excellent reading, but the reader's interest grows to envy when he reads of a "new" abandoned city, the deserted Coba, of which the author learned through the recent publication of a Spanish version of a Maya historic document, and for which he sought successfully.

Coba lies some 50 miles east of the ruins of Chichén-Itzá; the latter has been photographed and described ever since the visit of Stephens in the middle of the nineteenth century, yet Coba had, apparently, never been seen by an archæologist until Dr. Gann made his way there. The road, nevertheless, was well marked enough, for a great causeway, paved with limestone blocks and raised above the tropic bush, led to what must have been a great ceremonial centre. The position as described by Dr. Gann is magnificent, the elevated buildings "filling up almost the whole of a little isthmus separating two beautiful clear blue lagoons"; the Caribbean Sea is but 30 miles away to the east, but the ruins "are situated in the least known and most sparsely populated region of Yucatan," with the nearest village "twenty miles away, through an almost trackless wilderness, traversed only by chicleros and Indian hunters."

The complex of buildings was, of necessity, surveyed only in a cursory manner on this occasion, for the simple but sufficient reason that "we had barely two days' provision left"; but flat-roofed buildings, whose walls were covered with brightly coloured stucco, surrounded by the characteristic Maya room of the narrow arched type, were seen amongst the groups. "At one place," says Dr. Gann, "a flight of stone steps descended from a flat-topped mound to the lagoon margin, and was continued as a pavement along the floor of the lake itself, forming a delightful bathing-place and wharf for canoes, for both of which purposes it was doubtless used by the ancient inhabitants."

Obliged to leave this pleasant spot, to which it is hoped the scientific explorer will return for complete investigations, Dr. Gann pursued his journey to pay a flying visit to Lubaantun, and to spend some days at the famous ruins of Copan, just across the Guatemalan border of the Republic of Honduras.

Dr. Gann writes easily of day-to-day experiences, and he possesses the advantages of old residence among a Maya population, and knowledge of travelling and camping conditions in lovely but sometimes forlorn country where the ordinary white man, if separated from the trappings of civilization, would find himself in serious difficulties.

L. E. E.

The Land of Magellan.— W. S. Barclay. London: Methuen & Co. 9 × 5½, pp. 240. *Twenty-eight Illustrations and Three Maps.* 12s. 6d. net.

Mr. W. S. Barclay is a recognized authority on the subject of transport in South America; but if he looks upon mountains and deserts with the eye of faith that sees railways crossing chasm and plain, and if rivers suggest bridges, it is not because he does not also behold the romantic story of vast and untamed regions. And it is with romance rather than railways that he deals in the present entertaining and well-presented volume, although he makes the point that even now "in the last resort it is the sea passage round the Horn, or through Magellan's Straits, that governs freight rates quoted on trans-continental railways in North America."

"The northern routes across America are like gates that are pressed open wider each year to accommodate the increase of travel and commerce, but which may on emergency be closed. In the final arbitration of trade or of war, the sea-route by the land of Magellan holds the key to the Pacific, for . . . the Cape Horn passage is the only one, at all times and under all circumstances, politically and actually free to vessels making their way into either ocean."

The whole story of Magellan's magnificent voyage is told with attention to historical detail and to the economic results of the return of the little *Vittoria*, spice-laden, from the circumnavigation of the globe; and the author proceeds to explain the effect of the finding of the southerly water route upon the plans of Spain. Drake's discovery of Cape Horn, the unfortunate colonizing attempt of Pedro de Sarmiento in the inhospitable Magellanic regions; the voyage of Cavendish, and of the Dutch navigators, are followed by the odd story of the fabulous "City of the Cæsars," part of the romance of Patagonia that, says Mr. Barclay, received its death-blow only in 1902, when the Chile-Argentine boundary was fixed.

Every one who knows the native tribes of South America will agree with all that Mr. Barclay says of the unhappy folk of the Magellanic country, losing personality and vitality after contact with the civilization of white races; the numbers of the Yaghans, he says, have dropped in three generations to vanishing-point; the Onas, in less time, from 2500 to about 400; while to-day there are no more than 800 Alacalufs. "It cannot be long now before camps of the Fuegian Indians become as scarce as the seal-rookeries on the outer islands of Cape Horn, and their final disappearance will cause almost as little comment."

Perhaps the most interesting chapters of all are those dealing with the experiences of the author in the fringe of the region, little known and almost never described; he is at home in the region of "rainbow gold"; when fishing off Ushuaia; or when in Beagle Channel and in lonely Lemaire Strait; but to the ordinary traveller all the region is, as Mr. Barclay says, still almost *terra incognita* beyond the boundaries of the great sheep stations, for "hardly one of its clustered peaks has yet been scaled, and these look to one another across a land where forest, stream, and fell mingle in bewitching confusion."

Mr. Barclay's succinct and critical style adds to the value of a thoroughly competent volume. The illustrations are good, the index adequate, and the map exactly what is needed.

L. E. E.

AUSTRALASIA AND PACIFIC ISLANDS

The South Seas of To-day: being an account of the Cruise of the Yacht "St. George" to the South Pacific.— Major A. J. A. Douglas and P. H. Johnson. London, New York, Toronto, and Melbourne: Cassell

& Co. 1926. 9 × 6, pp. xiv. + 296. *Thirty-nine Illustrations and Three Charts.* 21s. net.

Sea-girt Jungles: the Experiences of a Naturalist with the "St. George" Expedition.—C. L. Collinette. London: Hutchinson & Co. 1926. 9 × 5½, pp. xiv. + 274. *Sketch-map and Illustrations.* 18s. net.

Both these books give some general account of the voyage of the party of naturalists who left Dartmouth in the spring of 1924, in the yacht *St. George* for research work in some of the smaller Pacific islands, which, in that they lie outside the regular track of steamers, have been less closely studied by scientific folk. The scheme of the expedition was excellent; and it is much to be regretted that circumstances—chiefly inadequate financial support—brought the expedition to an end before it had reached more than a very few of the less known islands which it was intended to study.

From Dartmouth the track followed was by Madeira, Trinidad, and through the Panama Canal, which places no longer offer any especially novel experiences to scientific explorers. But from the Pacific end of the Canal some of the smaller islands lying off that part of the coast were visited, and these gave some opportunity for good work to the naturalists. After that the yacht passed to the Galapagos Islands, which, despite the fact that so much has been written about them—especially by Darwin and the officers of the *Beagle*—remain, and must always remain, of quite exceptional interest to naturalists. The Marquesas Islands and the Tuamutu Atolls were also visited; and, after a stay at Tahiti, the more rewarding Austral Islands and "Lonely Rapa" were examined. And then the long homeward journey was necessarily begun.

In the book above first named Major Douglas—who seems to have been the chief originator of the expedition—and Mr. P. H. Johnson, each responsible for about half the chapters, have given a general account of the incidents of the voyage, Major Douglas dwelling with somewhat more appreciative care than his colleague on the scientific observations made. But it is distinctly stated in the Introduction to this book that the scientific results must be looked for "in the journals and reports of the various institutions that received the numerous specimens that were brought back."

In the second book above named Mr. Colinette, Fellow of the Entomological Society, makes no attempt to tell the story of the whole expedition, but has jotted down, from time to time, some really vivid notes of his experiences on the occasions when he was able to hunt for butterflies, moths, and beetles in places which were just on or beyond the fringes of civilization. For instance, his account of the night he spent alone, camped far up in the almost pathless jungle which clothes the side of Mount Temetio (Hiva Oa), the highest mountain in the southern group of the Marquesas Islands, makes delightful and almost thrilling reading; as does the story of what he saw during the three weeks which, with some of his colleagues, he spent when "marooned" on the little island of Coiba, 300 miles off the coast of Costa Rica: almost uninhabited when visited by Mr. Scoresby Routledge in 1916, this island is now invaded by the civilization implied in its having become a convict station from Panama.

Of the two books, that by Mr. Colinette is very distinctly of greater scientific interest; but neither adds much to geographical knowledge. Both books are provided with good indexes, with but poor maps, and with a large number of photographic illustrations, some of which, especially those in Mr. Colinette's book, are interesting and valuable.

E. im T.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Aims and Methods in the Study of Vegetation.— Edited by A. G. Tansley and T. F. Chipp. Published by the British Empire Vegetation Committee and the Crown Agents for the Colonies. London: 1926. 9 × 6, pp. xvi. + 384. *Illustrations.* 12s. 6d.

This is the firstfruit of the activity of the British Empire Vegetation Committee, set up as the result of the first Imperial Botanical Conference, held in London in 1924, and is intended "to give actual and potential workers a statement of what is meant by the study of vegetation, . . . together with some account of the methods which field workers have actually used." In addition to the editors a number of other investigators have taken part in its production. It is admirably illustrated, contains full references to the literature, is adequately indexed, and constitutes a very important addition to existing books dealing with plant ecology. As it is a quasi-official publication, certain to be re-issued as it runs out, we propose to limit this notice to some suggestions which might be considered for future editions.

The book is divided into three Parts, named successively General, Regional, Types of Vegetation. The basis of the distinction between the articles in Parts II. and III. is by no means obvious. It is presumed that the word "Regional" as applied to Part II. is meant to imply that this section is devoted to the methods of study applicable to the different climatic regions of the empire, while the articles in Part III., which are certainly what the geographer would call Regional, present the results of investigations. But even this distinction does not hold. For example, Dr. Dudley Stamp's article in Part I., entitled "Some Special Aspects of Vegetation Survey in the Tropics," gives an account of his own work in Burma, in addition to discussing suitable methods of survey in such tropical regions. On the other hand, Prof. J. W. Bews' article in the same part on "Vegetation Study in Sub-tropical Regions" consists only of general notes, with no definite reference to sub-tropical regions beyond the fact that his own work has been chiefly done in sub-tropical South Africa. We would suggest that a rearrangement of material in these two Parts would economize space, and would also result in great gain from the point of view of logical and orderly development.

Again, since the book has an immediate practical aim, it would seem to be desirable that Part I. should give only as much of the theory of the subject as experience has shown to be necessary for the field worker, and that the special articles should illustrate and exemplify the general statements made in it. From both points of view, we would suggest, modifications are desirable. On pp. 21 *et seq.* an account is given of Raunkiaer's Scheme of Life Forms, and it is stated that the "spectrum" of the various life forms (*i.e.* the percentage distribution of the different classes in the whole flora) gives an excellent key to the climate. But the subject is not raised again throughout the book, save for a passing reference on p. 272, and though Dr. Chipp, who as one of the editors is presumably in part responsible for the General section, contributes a special article on West Africa, with a somewhat detailed "Physiognomic Classification," there is no reference to Raunkiaer's Scheme, not even a cross-reference to the previous discussion. There is indeed virtually no reference to climate at all in this article, not even to the conditions which appear to control the distribution of forest and grassland. Curiously enough, also, though the climatic factors are fully discussed from the general standpoint in Part I., by Dr. Stamp in his article in Part II., and by Prof. Troup in his article on Indian forests in Part III.—where the treatment of monsoons is a little

"old fashioned," especially as regards the cool season rainfall of the Madras Presidency—most of the authors ignore the subject entirely, and there is a flat contradiction between the editorial statements on p. 99 and those of Dr. Stamp on pp. 241-2. On the former page it is stated that in the hotter regions of the world the total amount of rainfall in the year influences the vegetation to the extent that the heaviest rainfall corresponds to the wet monsoon forest, and a much lighter one to climatic grassland, while the correspondence between rainfall and vegetation is much less marked in cooler countries. But Dr. Stamp states emphatically that "woodland does not pass into grassland merely by decrease of rainfall," and that, while parts of Burma have the same total rainfall and temperature range as parts of the Sudan, there is no natural grass-land in Burma because it has "a woodland climate."

This particular contradiction is but one illustration of the enormous editorial difficulties involved in the preparation of so comprehensive a book. In any re-casting, however, we think that it would be an improvement to have cross-references from the general to the special sections, and the editors would be well advised to have the paragraphs relating to climate revised by a climatologist, and to insert references to books on climatology.

M. I. N.

GENERAL

Leaves from a Viceroy's Note-book and Other Papers.— The Marquess Curzon of Kedleston, K.G. London: Macmillan & Co., Ltd. 1926. 9 x 6, pp. vi. + 414. *Illustrations.* 28s. net.

The literary executors of the late Lord Curzon found among his papers a collection of essays intended to make a sequel to his 'Tales of Travel.' In publishing them they deplore the absence of the final polish which was so characteristic of everything that Lord Curzon wrote, yet commend them to the reader for their charm, gaiety, information, and style. They are indeed, in the longer papers, packed full of information admirably arranged, the fruit of that passion for inquiry which so greatly distinguished Lord Curzon as a traveller, and did not fail in his later political life. Though he declares that "in a descriptive article nothing is so detestable as history," the historic background is there all the time as richly figured as in a chapter of Macaulay. The two chapters on the Monasteries of the Levant, written as a commentary on the celebrated account of them from the pen of his kinsman, display his admirable blend of historical and geographical penetration: the account of Hué, capital of Annam, his equally dexterous combination of politics and archæology.

The most important chapters of the book, roughly a quarter of the whole, deal with the North-West frontier of India, which he visited as a Member of Parliament and correspondent of the *Times* only a few years before he ruled it as Viceroy: the intervening years seeing the most acute of the frontier troubles. The younger officers whose methods he studied and whose ideas he absorbed in 1894 had—those of them who survived the adventures of the years between—the satisfaction of serving as seniors under a young and enormously capable and energetic Viceroy who knew the frontier as widely, if not as minutely, as they did. Many of them are still living to read with satisfaction his vigorous defence of the frontier policy they administered, and his eloquent appreciation of their work and its happy results for the peace and well-being of those wild and magnificent regions.

There are passages in the *Pages from a Diary* of word painting in the grand style; pungent remarks on his forerunners in travel, as upon Froude, who was pressed with damnable iteration not to miss the Yosemite Valley, without

arousing the concern of that implacable man. But examined critically the style of the writing is perhaps a little over-loaded, and we miss that compelling power of language that made Lord Curzon so formidable in debate, and so difficult to contest in council or negotiation.

In the forefront of their commendation to the reader his literary executors put his charm and gaiety. Now, in writing of his earlier book of travel the reviewers detected a schoolboy element in his humour rather strangely out of keeping with the mature productions of so great a man, and there are a few passages in the present book which editors without his express authority for publication might have thought it more discreet to suppress or postpone for a while, such as the curious account of the valet who impersonated the Viceroy more than once on occasions of ceremony or the satiric story of the visit to Goa. The chapter called "The Old Persian" is a remorseless identification of the characters in Morier's *Haji Baba* with the leading Persians of Morier's acquaintance—an interesting private exercise, but surely a little unkind even so many years later: informing, and possibly useful, but not charming.

The book is abundantly illustrated with excellent photographs mostly attributed to various press agencies, though in at least one case clearly identifiable as the work of a recent traveller: compare the plate facing p. 196 of the book with the plate facing p. 388 of the *Journal* for November 1925. There are no sketch-maps, though one is badly wanted to illuminate the chapters on Gilgit and Chitral.

The "Arcturus" Adventure.— W. Beebe. New York and London: G. P. Putnam's Sons. 1926. $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xx. + 439. *Illustrations and Maps.* 25s. net.

The *Arcturus*, a finely equipped oceanographical yacht of 2400 tons, was sent by the New York Zoological Society to explore the Sargasso Sea and the Humboldt Current. In this volume Mr. Beebe gives a popular but yet scientific account of the five months' cruise. He has produced a fascinating volume fully equal in interest to his previous book on the Galapagos (reviewed in *Journal*, 64, p. 259), and even better illustrated than that beautiful volume. A few more books of this nature should succeed in popularizing the science of oceanography and awakening a lively interest in the wonders of ocean life. After a short cruise in the Sargasso Sea, where the waters proved too rough for the American oceanographers, the *Arcturus* went through the Panama Canal in search of calmer seas, and devoted the remainder of her cruise to the waters between Central America and the Galapagos Islands, with a visit to Cocos Island. On her return she paid some attention to the submerged Hudson Gorge, south of New York. No trace of the Humboldt current was found about the Galapagos, but a curious current rip was met to the south of Cocos Island, caused by the convergence of two warm westward-flowing streams. It was a paradise for the zoologists, abounding in animal-life and drifting *débris*, and frequented by many birds. The equipment of the *Arcturus* included many ingenious devices, including a bow "pulpit" that could be lowered to the level of the water, and a boom walk not unlike the pirates' plank in construction. But the plan of trailing plankton nets from a boom on the weather side was not the novelty Mr. Beebe claims for it, but has been in use for some thirty years. The most striking piece of equipment was a 60-lb. diving helmet, which, lying on the shoulders by its weight, enabled a man to descend in shallow water to watch the animal-life and move freely, unencumbered by a diving suit. An air-pipe was, of course attached. This device furnished the material for many of the pages of graphic description that are

a feature of the book. One interesting result of the expedition was the discovery of an albatross rookery on Hood Island, and we are also given a full account of the story of buried treasure on Cocos Island. But from end to end the book is full of charm and interest, enhanced by the excellent photographs and many coloured plates.

R. N. R. B.

Sir Cornelius Vermuyden.— J. Korthals-Altes, F.Hist.S. (Ned.). London: Williams & Norgate; The Hague: W. P. van Stockum & Son. 1925. 10 × 6½, pp. xii. + 202 + 208. 21s. *net*.

This is a history of the life-work of Sir Cornelius Vermuyden, the great Anglo-Dutchman and authority on land reclamation and drainage. The author describes the work of Vermuyden in draining the fen districts in England. In the first chapter he gives a brief history of the parts of the counties of York and Lincoln in the neighbourhood of the Humber and the Trent, the period covered going back to 44 B.C., and the various efforts at drainage and reclamation are briefly mentioned.

In chapter 2 the history is brought up to the date when Cornelius Vermuyden was summoned to England by the King in 1621 owing to an inundation following the overflow of its banks by the Thames near Dagenham. The various difficulties and vicissitudes met with by Vermuyden are then described somewhat at length, and following this the author sets forth his own views on the present conditions of drainage in England, and makes suggestions for the future. A *résumé* of the drainage legislation of Holland is also given.

The book should be found of use by those interested in the history of the reclamation of marsh lands in England, but its value as a reference work is detracted from by the absence of an index, which makes it somewhat difficult to use, considering that there are 202 pages of letterpress, followed by 208 of appendices, the only guide to which is to be found in a brief list of contents occupying about half a page.

J. S. O.

Travel and Adventure in Many Lands.— Cecil Gosling. London: Methuen. [1926.] 9 × 6, pp. ix. + 294. *Illustrations*. 10s. 6d. *net*.

In Many Parts.— Lieut.-Col. W. P. Drury, C.B.E. London: T. Fisher Unwin. [1926.] 9 × 5½, pp. 251. 12s. 6d. *net*.

The title of Mr. Gosling's book is well justified by its contents. Before he was twenty years of age he had acquired several European languages and had already visited Guatemala, where as horseman, sportsman, and budding diplomat he had some exciting adventures. His next sphere was South Africa—and active service with the British Bechuanaland Police in Matabeleland. His reminiscences of this period of South African history are interesting, but his stay there was cut short by ill luck, and he returned to England, only however *en route* for Spanish America again. Entering the Consular Service, he rapidly advanced, from Vice-Consul at Cuba prior to the Spanish-American war, and Consul in Paraguay, to Minister at La Paz. In each country he endeavoured to see all that was to be seen, undeterred by hardships or dangers, from which his coolness and determination always extracted him, and to understand the life of the people. He gives first-hand accounts of the "New Australia" settlements in Paraguay, and of the rubber estates of the upper Amazon basin. His style is frank, unembellished, and often outspoken. One or two small slips may be accounted for by the fact that he writes from memory.

To rival this book in the number of adventures or the range of travel would be difficult. Colonel Drury would not make this claim for his, for his title

refers rather to "rôles" than to "foreign parts." As a Marine, however, his service has taken him to the Mediterranean, the East, and the Antipodes; but the early part of his book is interesting as a description of life in the Marines, ashore and afloat against many fleeting backgrounds, in the closing years of the last century. Later Colonel Drury played other parts, as author, playwright, and strong supporter of Lord Roberts' National Service Scheme, until the war brought him back to his earlier sphere. His reminiscences are well told, with a pleasant touch of humour.

Excursions and Some Adventures.— Etta Close. London: Constable & Co. [1926.] 9 × 5½, pp. viii. + 296. *Illustrations.* 12s. net.

Though Miss Close's excursions range from Spain to Japan, from Norway to Morocco, the main interest throughout are the personalities of the authoress and her mother. Often unaccompanied and without definite plans, the travellers always displayed resourcefulness and high spirits, and these reminiscences are written in the same mood. "Excursions" is a more modest title than some might employ, for even to-day many of the journeys would be off the well-beaten track, and were naturally more so at the beginning of the century. Miss Close is really more intrigued by the people she encounters than interested in the regions she traverses, and she is most entertaining when describing the Shereif of Wezzan, the English manager of a manganese mine in Asturias, or the millionaire from Nome.

THE MONTHLY RECORD

EUROPE

Movement of Population in France, 1881-1921.

THE question of the population of France has received much attention lately; a further study on a regional basis of the census returns for 1881 and 1921 by M.M. A. Demangeon and M. Matruchot is published in the *Annales de Géographie* for November 1926. The results are based upon the returns for each canton, arranged in several groups of increase and decrease. Excluding Alsace-Lorraine, 617 cantons showed an increase, and 2344 a decrease. In each of the departments of Alpes Maritimes, Basses Alpes, and Lot, two cantons had decreased 50 per cent. The homogeneity of these areas is brought out by the departmental figures: in eighteen departments all cantons, or all but one, had decreased; only in six departments had more than half the cantons increased. There are six main areas of depopulation. The largest and most uniform of these are the Aquitaine basin, and Eastern France from the Meuse and Ardennes to the Doubs, from the Nièvre to the plain of Alsace. The former, comprising mainly the middle basin of the Garonne and stretching to the Central Pyrenees, is a rich and fertile land, which is going out of cultivation through the decreasing birthrate, and in spite of the influx of Spanish, Italian, and other labourers. North of Cahors, fourteen cantons have decreased more than 40 per cent., while Cahors itself has fallen from 15,524 to 11,866 inhabitants. The Eastern area, too, the calcareous plateau, is a fertile country: here the decline is attributed to the decay of corn-growing through foreign competition, the turn-over to pasture, and the antiquated and wasteful land system. Other regions showing large but not so striking decreases, are Basse Normandie (Manche, Orne, Calvados occidental), with a low birth-rate, a change from cultivation to pasturage, and decaying domestic industries; the devastated

areas, where twelve cantons have decreased more than 50 per cent.; the Alpine area, with two centres of maximum depopulation, between the Durance, and the Côte d'Azur, and between the Durance and the upper Drac; and, finally, the Massif Central. This last area shows several internal variations, apart from its urban centres. Thus Cantal and Lozère, though both mountainous and poor, show slight decreases, through high birth-rates and peasant tenacity. Greater decrease has occurred between the Loire and the Saône, caused by urban attraction and in some degree by the abandonment of vineyards; in the eastern Limousin and Marche areas, a poor land with a high birth-rate; and in the southern Central Massif, where the conditions are similar.

The areas of increase, apart from small urban and industrial centres, are four: The industrial region of the north around Lille, Arras, and Maubeuge; the Paris basin; Western Brittany—"Breton Brittany," where the birth-rate is high; and the coastal areas in general. The increase of population along the Northern, Atlantic, and Mediterranean coasts, with but few gaps, is one of the striking results of the survey. It is to be hoped that the authors will succeed in preparing similar maps for the years 1801 and 1846, which would show the effects of industrialization.

Swiss Hydrographical Researches: Lake of Constance and R. Maggia.

A project for controlling the level of Lake Constance and its outflow is discussed at great length, with many diagrams and maps, in the Swiss *Mitteilungen des Amtes für Wasserwirtschaft*, No. 20, 1926 (Karl Koberlit, "Die Regulierung des Bodensees"). Plans for securing protection from floods through the rise of level of the lake had been discussed frequently, but only in recent years have proposals been put forward which, in addition to securing this, would also provide hydro-electric power and improve the navigation of the Rhine. The study opens with a detailed hydrographical analysis of the lake, based upon records extending over a century, and on work specially carried out, such as charting the Konstanzerbuch, preparing profiles of portions of the Rhine, and carrying out levellings. The problem is to lower the high-water mark of the lake without at the same time greatly increasing the total outflow or reducing the low-water mark appreciably. The first limitation is of course dictated in consideration of the lower Rhine valley. The proposed works include the deepening of the Rhine bed between the Upper and Lower Lakes, and between the Lower Lake and Schaffhausen, in order to allow as much water to escape at the proposed new lake-level as flows out at the highest level at present. Then the flow of the lake would be controlled by a dam across the Rhine near its exit, either at Hemishofen or at Rheinklingen. The average yearly difference in the level of the lake is 2.08 metres; the difference between the highest and lowest observed levels is 3.98 metres. This dam would be provided with locks for ships, and would also be the site of the power installation. It is thought that by this means the high level of the Lake could be reduced by 70-80 cm., and that the average annual high-water level would not approach within 50 cm. of the danger line. Some 2100 ha. would thus be saved from floods. The total initial outlay is calculated at 15 million francs, and the time for building at six years.

Another publication of the same Department deals with the growth of the delta of the Maggia in Lake Maggiore (H. Bircher, "Il delta della Maggia nel Lago Maggiore"). The work was carried out at the beginning of 1926, and full details are given of the methods of obtaining the data for the seventeen profiles obtained. A certain number of soundings from a survey made in 1890 permitted a comparison to be made. From this somewhat limited detail,

it is calculated that in the thirty-five years approximately 20 million cubic metres have been deposited almost entirely by the Maggia, or approximately 570,000 m.³ per year. For the basin of the Maggia this amounts to 612 m.³ per km.², compared with the previously calculated figure for the Rhine basin above Lake Constance of 456 m.³ per km.² (see *Geogr. Journ.*, 1924, 63, pp. 454-5). The report is accompanied by two bathymetrical maps on the scale of 1 : 7500.

Estonia.

The Institute of Geography of the University of Tartu (Dorpat) is actively engaged in gathering the material for a sound knowledge of Estonia. We have already noticed (*Geogr. Journ.*, 66, 174) a valuable general essay by Dr. M. Haltenberger, "Gehort das Baltikum zu Ost-, Nord-, oder zu Mitteleuropa?" He has recently published a more detailed study on Estonia, "Landeskunde von Eesti" (Publ. Inst. Univ. Dorpat. Geogr., 6-10). Some of the more general points may be noted here. Geographically, Estonia is not sharply defined from the surrounding regions; it is a corner of the Russian palaeozoic tableland, of which the surface relief here is due almost entirely to the glacial period. Characterized by drumlins, moraines, and eskers, its average elevation is 50 metres. Approximately one-sixth of its area is swamp and moorland, and there are one thousand lakes, few of which have an area of more than 1 qkm. This being so, the writer is at pains to show that the community has an ethnological unity; of the total population, which just exceeds one million, 87 per cent. are Estonians. The residue, mainly living in the towns, are Russians, Germans, and Swedes, in that order of importance. The people are predominantly agriculturalists; in the south-east circle of Petseri, the zone of glacial accumulation, the percentage is as high as 90, the highest industrial population being in Harju, 26 per cent., in which Tallinn (Reval) is situated. As elsewhere in Eastern Europe, a feature of the post-war social legislation has been the transference of landed property to the peasants. At present 68 per cent. of the land belongs to peasant proprietors. It is perhaps too early to trace the effect of this change upon production. Apparently the average yield of potatoes and autumn rye is now lower than in pre-war years, while that of oats and barley has increased.

Possessing few minerals of economic importance, Estonia's industries are agriculture, dairy and cattle farming, and forestry. The main crops are rye and potatoes in the western islands and northern districts, and oats, barley, and flax in the southern. Cattle are kept mainly in the moister western regions. Forests cover 40 per cent. of the area. Thus of the exports, flax and other fibres form 23 per cent., timber and wooden goods 22 per cent., textiles 18 per cent., dairy produce 15 per cent., and paper 8 per cent. Most of the dairy produce goes to Germany, and practically all the timber to Great Britain. It is more striking that 34 per cent. of the imports are foodstuffs. That the economic position is improving is evidenced by the reduction of the adverse trade balance from 36 million gold krone in 1923 to 3 million in 1924. In 1924 the features of the total foreign trade were, first, its rapid growth—it had increased three and a half times since 1920; secondly, the decreasing proportion of transit trade, from one-third in 1922 to one-fifth in 1924. Most of this originates in Russia, so that its decrease reflects the improving position in St. Petersburg as a port of export. In pre-war days, Tallinn was specially developed by Russia, and it remains still the economic centre of Estonia. It is not altogether sound that in an essentially agricultural country over one-tenth of the population should reside in Tallinn. This Dr. Haltenberger recognizes and points out that the

basis for the future prosperity is in agriculture and dairy farming along Dutch and Danish lines.

A River Canyon in the Crimea.

A little-known river gorge or canyon in the South-Eastern Crimea is described by I. Pusanov in *Zemlevedenie*, 1925, vol. 27, the publication of the geographical section of the Russian Society of Natural History. The gorge is in the Ausun-Usen river, near the village of Kokkos; it is parallel to the Yaila mountains, from which it cuts off the isolated Biyuka massif. The gorge is 3 km. long, 200–250 metres wide, and its almost perpendicular walls are 300 metres high. Though signs of river erosion are now to be seen, the gorge is obviously in a fault plane, and its course parallel to the Yaila mountains is not accidental. The north bank is considerably higher than the south. The whole region requires close study, but a series of faults, breaking the Jurassic limestone into a number of isolated blocks and depressions, can be traced.

AFRICA

The Climate of Helwan, Egypt.

A publication on this subject by Mr. L. J. Sutton (Physical Department Paper No. 20, Cairo, 1926) may be regarded as a companion to the same author's work on the climate of Khartoum (*Journal*, 63, p. 456). The site of Helwan, 14 miles south of Cairo, was selected for an observatory as representative of desert conditions of Saharan type. There is nothing of the terrific heat of Khartoum, the mean temperature of the warmest month, July, being only 82° F., or 3° below the mean of the whole year in the southern city, whilst January, the coolest month, is down to 54° F. The mean annual range of 38° F. is very large, that of Khartoum being only 23°, but this cannot without correction be taken as an expression of greater thermal "continentality" than prevails in the Sudan on account of the difference of latitude and the smaller change in the seasonal altitude of the sun in the inter-tropical latitude of Khartoum. The absolute range of the thermometer at Helwan during the period 1906 to 1920, between 115° F. and 35° F., is much the same as that observed at Khartoum, but the limits are slightly lower. It is pointed out that this absolute range is smaller than that recorded during the same period at some inland places in the oceanic climate of England—an instance, evidently, of the influence of latitude upon seasonal extremes of temperature.

The winter months in this part of Egypt are described as ideal for invalids. There is on the average as much as seven hours of sunshine a day in the dulllest month, December, or about as much as is enjoyed in the sixteen-hour day of May, June, and July in England. The hot season, May to September, when there is fierce sun-glare from the south, is debilitating, though frequent northerly winds tend to moderate the heat. Sandstorms occur, and despite a negligible rainfall occasional severe inundations. That a really low vapour-content is almost impossible for any length of time in warm latitudes is shown by a mean annual vapour-pressure of 9.0 mm., agreeing quite well with 8.4 at Khartoum as against 7.3 at Kew.

The Site of Tegazza.

We have received the following note from Miss E. G. R. Taylor:

"One of the puzzles of the early geography of West Africa has been the site of Tegazza, famous for its salt-mines. Careful plotting of Arab itineraries and study of historical references led the writer to the supposition that there were two Tegazzas, one to the north-west of Taodeni, and another in the

neighbourhood of Tichit. This is confirmed by a passage in J. G. Jackson's *Account of the Empire of Morocco* (1814), which runs :

" ' In going from Akka to Tagassa they employ 16 days ; . . . they then proceed to the oasis and well of Taodiny, which they reach in 7 days. . . . Their next route is to Arawau, . . . which they reach in 7 days ; . . . and then proceed and reach Timbuctoo the sixth day. . . .

" ' There is another Akkabaah which sets out from Wedinoon and Sok Assa, and traversing the desert between the black mountains of Cape Bojador and Gualata, touches at Tagessa El Gharbie, or West Tagassa, and staying there to collect salt proceeds to Timbuctoo ' (chap. xiii. p. 286)."

AMERICA

The Mackenzie District, North-West Territories, and the Yukon.

A comprehensive survey of a considerable portion of the Mackenzie District is given by Mr. G. H. Blanchet in a publication of the Department of the Interior N.W.T. and Yukon Branch—*Great Slave Lake Area, North-West Territories, 1926*. It is also interesting as describing stages in the opening up of an undeveloped area comprising about 125,000 square miles lying north of the 60th parallel, with the Great Slave Lake as the chief topographic feature. From several points of view it falls into two divisions, north-eastern and south-western. The former consists of the highly eroded pre-Cambrian rocks, the latter of drift-covered sedimentaries. The line of contact runs approximately down the Slave river and across to the North Arm of the Lake. The plains of the Mackenzie valley and the western end of the Lake contrast strongly with the discontinuous topography and bare rounded rocks of the scarps of the Laurentian plateau, and with the rolling eastern plateau itself, deeply covered with drift. The greater part of this plateau lies between 1000 and 1500 feet (the level of the Great Slave Lake is approximately 500 feet). The whole area displays signs of heavy glaciation, and the lower slopes are covered by old lake bottoms formed when the water stood at approximately the 1000-feet level in post-glacial times. The valleys of the Slave and Mackenzie rivers and the west generally have considerable forests, abundant hay lands, and moose, caribou, and other game, while some farming is possible. To the east forest is found in the valleys, but gradually disappears as the higher levels are reached. The Mackenzie and Slave rivers and the Great Slave Lake afford easy access to the area. On the Laurentian plateau, however, the drainage system is formed merely by lakes spilling uncertainly from one to the other. The eastern end of the Great Slave Lake penetrates well into this plateau, and the falls on its tributaries offer prospects for hydro-electric power sites. This eastern area also gives indication of mineral wealth, and it is upon this, and oil in the sedimentary rocks of the Mackenzie valley, that the hopes for the future are based, as farming can only be a subsidiary occupation.

The prospects of mineral wealth and the beginnings of the survey of the area were noted in the *Journal*, 60, 316. By 1924 the Great Slave Lake had been completely surveyed, and lines carried to the Great Bear Lake, and, in the east, to Lake de Gras and the Coppermine River. In 1925, 50,000 square miles of practically unknown country in the south-east were opened up, a reconnaissance being made up the Talston river, across the Hudson Bay divide, and some distance down the western branch of the Thelon river. The return to the Great Slave Lake was made by the Snowdrift river. Maps are issued on the scale of 1 inch to 4 miles for navigation and 1 inch to 6 miles for general purposes. Though the presence of great mineral wealth has yet to

be proved, the indications are promising. At present there are six settlements, administrative, mission, and trading. The Indian population approaches 2000.

Another recent publication of this Department deals with the Yukon Territory. Not more favoured by nature than the Great Slave Area for settlement, its development has resulted almost entirely from its gold resources, and this pamphlet deals principally with the mining industry. The output of gold in 1924 was valued at \$722,000, compared with the maximum output in 1900 of \$22,000,000. The prospect is not however as bad as this might imply, for the lode deposits have yet to be thoroughly examined, and it is stated that barely 20 per cent. of the Territory has been prospected. In the same period the population declined from 27,000 to 4000. The mining industry has stimulated others. Practically all the vegetables consumed are grown in the Territory, farming is increasing, and cattle and sheep are being raised. Similar developments are not impossible in the Great Slave Lake area.

Exploration in Dutch Guiana.

Scientific exploration in the interior of Dutch Guiana, which had been in abeyance for some time, was resumed last year by a well-organized expedition under Dr. Stahel, sent out under the auspices of the Society for the Scientific Exploration of the Netherlands Colonies, with substantial support from the Royal Netherlands Geographical Society. The special field of research is the Wilhelmina range, the central and most important massif in the colony, hitherto practically unknown, where both topographical work and natural history research were felt to be highly desirable, while an examination of the natural resources of this inland region was an important part of the programme. Besides the leader, in charge of the botanical and meteorological work, the *personnel* included Mr. R. Ijzerman as geologist, Dr. Fernandes as zoologist, and Mr. H. C. van Ommeren as medical officer, while the services of a trained surveyor, Col. Kremer, were placed at the disposal of the expedition for a limited period. Reports of progress have been printed as received in the *Tijdschrift* of the Netherlands Geographical Society for July, September, and November 1926 and January 1927, bringing the narrative down to the end of June 1926. The route chosen for the main party was that of the Surinam river and its western headstream the Gran Rio, while Col. Kremer with another section took the route of the Corantyn and its eastern tributary the Lucie, first explored by the expedition of Lieuts. Eilerts de Haan and Kayser in 1910 (see *Journal*, 37, p. 665).

The earlier reports of Dr. Stahel recount the experiences during the ascent of the Surinam and Gran Rio, the usual difficulties being experienced as regards the procuring of canoes, and the navigation of a river much broken by falls and rapids: some unruliness seems also to have been shown by the coolies recruited, it seems, from the "Bush Negroes" of the interior. On reaching the limit of navigation on the Gran Rio (where an inscribed stone was set up to mark the grave of Eilerts de Haan, who there succumbed to fever in 1910) a line was cut through the forest to the Lucie, and this descended to a spot considered most suitable for the overland trip to the mountains. Pending the arrival of Col. Kremer reconnaissances were carried out by Dr. Stahel and Mr. Ijzerman, and a track was cleared by the coolies towards the summits of the range, from which it was proposed to carry out a survey by means of triangulation. One of the peaks, supposed to have a height of 1280 metres (4,200 feet), was climbed and arrangements made to clear the summit of this and other peaks as stations for the triangulation. At an altitude of 900 metres it began to feel cold, and the vegetation suddenly changed, that of the lower

levels giving place to *Cyperaceæ* of the height of a man, big ferns, and (on the actual summit) thickets of dwarf bamboo. Everything was covered with thick cushions of moss dripping with moisture. The whole narrative is interspersed with interesting notes on the plants and animals seen (the latter including jaguars, tapirs, monkeys, peccaries, etc.), and there are special reports on the geology by Mr. Ijzerman. The principal formations are granite, and diabase of two distinct types. A good many *balata* trees of the best kind were seen, and the district is likely soon to become a collecting-ground for this valuable product. Dr. Stahel gives notes on various crafts (including canoe-making) of the Bush Negroes, illustrating them by drawings.

Eastern Bolivia.

A little-known and inaccessible part of Bolivia is described by O. Schmieder in the *Geographische Zeitschrift*, Heft 8, 1926. The east Bolivian upland region lies between the more elevated Puna and the plains of the Chaco, and possesses distinct characteristics. Structurally the area is a series of almost parallel north-and-south ridges, produced by strong tectonic pressure from the west forcing the Mesozoic sandstones and conglomerates into abrupt anticlines. Where the pressure has been stronger overthrusting rather than recumbent folding has resulted. These long steep but low ridges run for several hundred kilometres, at an elevation of 1500-2000 metres. To the east, the intervening valleys are wider, 3-4 kilometres, with flat sandy floors similar to the Chaco. The summer rainfall averages 200 cm., but it varies much from year to year, and is received often as cloudbursts. The summer heat and the high relative humidity is oppressive. The drainage is generally from south to north, or the reverse, but occasionally the larger streams, such as the Parapiti and Pilcomayo, break through the ridges in deep narrow gorges, probably formed by regression. The region is particularly difficult to traverse: progress from east to west is very laborious through the constant ascents and descents. The river gorges are of little use, as they are liable to sudden and dangerous floods. If the journey is made in the dry season fodder for the animals is hard to obtain. The wooded ridges assume a tropical appearance during the rains. On the higher western Andean slopes "pino" and alder forests occur above the 1800-metre line. The native inhabitants, Chiriguano, immigrants from the upper Paraguay region in the sixteenth century, maintained active opposition to outside influences down to a decade or so ago. Their numbers are declining rapidly, through malaria and other introduced diseases, and through emigration to the economically more active areas of the northern Argentina. Considerable work has been done by Catholic missions, but these are declining and stations are being abandoned. Economically, the region is undeveloped through lack of communications, not from unproductiveness. Maize is grown, pigs raised in the forests, and cattle on the Chaco borders, but outside markets are almost unreachable, and Argentine competition is strong. The prospects for future development depend upon the results of the boring for oil which is at present being carried out, with, it is said, some success.

POLAR REGIONS

Projected Argentine Expedition by Air to the South Pole.

We have received from the author, Señor Antonio Pauly, the copy of a lecture delivered by him last June under the auspices of the Sociedad Argentina de Estudios Geográficos, in which plans were developed for an expedition by aeroplane across the South Polar continent, the exploration of

which, it is pointed out, the Argentine is specially called upon to undertake by reason of her geographical position. Although the project appears to have been pretty thoroughly thought out, and is set down in considerable detail in the paper in question, we are not told how far, if at all, it has yet met with practical support, and the latest news is to the effect that its execution has been postponed for another year, it having been found impossible to carry it out during the present Antarctic summer. The main idea is more or less a revival of Sir Ernest Shackleton's project for a trans-polar journey, only with different and, it is held, more promising means, due to the recent advance in aviation. The starting-point would naturally be on the American side, Wandel Island, off the west coast of Graham Land, being chosen as the most suitable spot for the main base, both on the score of accessibility by sea and because of its generally level surface. Here a scientific station might be established, but only as subordinate to the main expedition. For this a reconnaissance would be carried out by air with a view to choosing a site for a more advanced base on the coast or in the interior of Graham Land, somewhere about the latitude of 70° , and a depôt of petrol would be formed here by a succession of flights from the main base, while exploratory flights would also be made, one to the Weddell Sea, the other to Charcot Land. The final flight across the polar continent would start from this advanced base, landings being made *en route* for the purpose of scientific observations. The ultimate goal would be McMurdo Sound (written "McMurdock" in error), or some other point in the Ross Sea area, where depôts of provisions either already exist or could be laid down by arrangement with the whalers who frequent those regions.

A large part of the paper is taken up with a summary of the physical conditions of the area to be crossed, and Señor Pauly has evidently made himself thoroughly at home with the results of previous work, particularly as regards the meteorological conditions that may be expected to prevail, though the precise influence these would have on the chances of success or otherwise is not very clearly brought out. He lays stress throughout on the facilities for air work afforded by the level expanse, both of the Antarctic "barrier" ice and of the surface of the polar plateau, and he justly insists on the valuable results for geography and kindred sciences that would be yielded by a successful expedition of the kind. Whether he has sufficiently taken account of all the difficulties and chances of misadventure is perhaps open to question. In the choice of the type of aeroplane advantage would of course be taken of the experience of Amundsen, though it is pointed out that the conditions in the Antarctic differ considerably from those to be reckoned with in the north. Another point of difference is the entire absence of local food resources in the south, rendering it necessary for the party to take with them supplies for the whole journey, with a margin also for emergencies. An extra two months' supply of provisions is spoken of, but it is not quite clear how room for this is provided for, the main attention being devoted to the carriage of the petrol. Señor Pauly has had considerable experience of travel in the Andes and other parts of South America, and thinks it possible to do better work with small means well employed than with the elaborate equipment taken by some expeditions. The paper includes notes on the scientific programme and equipment.

GENERAL

Captain Cook's Voyages.

Frequent mention is made by Captain Cook in his journal of his second voyage (1772-75) of a number of medals which he distributed among the natives of the Pacific Islands "as testimonies of our being the first discoverers."

There is a medal in the Banks' Collection in the British Museum and the Royal Mint which is undoubtedly a specimen of those thus distributed. It bears on the obverse the head of George III., and on the reverse two ships, with the inscription "Resolution Adventure. Sailed from England March MDCCLXXII." That this was the medal distributed by Cook is supported by descriptions of the medals actually given to the natives, though none of these have been recovered. (See 'The Quest and Occupation of Tahiti by Emissaries of Spain during the years 1772-1776,' Hakluyt Soc., Series II., Vols. 32, 36, ed. by Dr. Corney, and a further article by him in the *Numismatic Circular*, 1916.) Up to the present, however, no details of the circumstances of their manufacture or of the engraver have been known.

In a recently published pamphlet, 'Matthew Boulton's "Otaheite" Medal' (Birmingham, 1926), Mr. A. Westwood gives extracts from correspondence between Boulton and Sir J. Banks referring to the production of a medal, apparently designed for Cook's second voyage, on which Banks then intended to go. As no other similar medal is known to exist, these references are in all probability to the medal in the Banks collection, though no detailed description is given. It is also established that the engraver of the medal was John Westwood (1744-92), a Birmingham medalist, and not William Barnett or Edward Birch, R.A., as has generally been assumed. This was Boulton's first attempt at medal striking, but he ultimately secured the contract for the copper coinage struck in 1797. He was subsequently associated with James Watt in the historic engineering firm of Boulton and Watt. It will be remembered that Banks did not sail with the second expedition in the end, through a dispute over the accommodation for the scientists on board the *Resolution*, and that re-arrangements delayed the start until July. It is probable, therefore, that on his withdrawal the Admiralty took over Banks' stock of medals.

Another publication dealing with Cook's voyages may be noted here. This is a translation by Miss Tewsley of Zimmerman's account of the third voyage, 1776-80 (originally published in German in 1781; see *Journal*, 68, 174), issued as Bulletin No. 2 of the Alexander Turnbull Library, Wellington, N.Z., under the direction of Mr. J. C. Andersen. Zimmerman, who was an interested observer, gives from the point of view of an ordinary seaman a brief but clear account of the voyage, of the native customs, and especially of the relations between the crews and the natives, and he describes in more detail the events leading up to Cook's death. He held a very high opinion of his captain's character, but does not hesitate to criticize some of his actions. He mentions incidentally that Cook distributed medals of King George III. to natives of Van Diemen's Land, though Mr. Westwood in the first pamphlet does not specially mention medals for the third voyage.

Congress of Slav Geographers, June 1927.

We have received an intimation that the Second Congress of Slav Geographers and Ethnologists will be held this year in Poland between the 1st and 11th of June, and that visitors from other countries will be admitted to take part in it. The meetings will take place at Warsaw and five other Polish cities in turn, and two special trains will be at the disposal of the members, in which it is proposed to make a tour through a considerable part of the country. The president is Professor E. Romer, and the secretary Professor L. Sawicki, the offices of the organising committee being at 64 Gradzka, Cracow.

OBITUARY

Sir John Scott Keltie.

WE have to record with the most profound regret the death of Sir John Scott Keltie, on the afternoon of January 12, after an illness happily very brief. He was present at the Evening Meeting of December 20 very much in his usual health. During the last few years his powers had been a little declining, and his memory not what it was ; but he preserved the fresh and vigorous air of a man twenty years younger, and except for occasional touches of bronchitis had been well and active, the most regular attendant at the Council, and the most punctual member of the Geographical Club. On the morning of the Council and Meeting of January 10 he wrote that his doctor would not allow him to come out, but on the following day he was asking when he might be allowed to do so ; and on the next he died after a few hours' unconsciousness. The familiar words of the Burial Service on those who come to fourscore years never seemed less appropriate than on the morning of January 15, when his sorrowing friends—past and present officers of the Society, members of the Council, colleagues on the staff, and many others—attended his funeral at the Hampstead Cemetery. He had retired from the office of Secretary in 1915 on reaching the age of seventy-five, but for more than two years after continued during the stress of the war to help in editing the *Geographical Journal*, of which he was the architect and builder. Before he finally retired on his well-earned pension he gave to a Meeting of the Society a vigorous retrospect of its thirty years' work since he joined its permanent staff as Librarian ; he continued to manage the affairs of the Geographical Club and to edit the *Statesman's Year Book*. He remained an active member of the Council of the British Association, collaborated in producing a series of excellent school readers on the story of Geographical exploration, of which the last appeared only a few months ago, and never really gave up golf.

In presenting to him the Victoria Medal of the Society in 1917, Mr. Freshfield said : " He has made himself, and in doing so he has made the Society, a geographical centre round which all good travellers revolve. . . . His correspondence has extended over the civilized world, and . . . Dr. Keltie has remained in the eyes of all men the incarnation of British geography." He would have wished for himself no better epitaph than these last words, and for the moment we will not attempt to enlarge them ; but we hope to publish in a future number of this *Journal* a memoir from the hand of one of his older friends.

Professor Jovan Cvijić.

A telegram from the Geographical Society of Belgrade announces the death, on January 16, of the eminent Serbian geographer, Jovan Cvijić, Professor of Geography in the University of Belgrade, and President of the Academy of Sciences. His many friends in this country who knew him during the years of war will realize the profound loss which Yugo-Slavia has suffered by the death of this talented geographer, of whose work on the geography of the Balkans we hope to give some account at a later date, associating all Fellows of the Society meanwhile with the telegram of sympathy which the President despatched to Belgrade on receipt of the news.

Oliver Robert Coales.

We greatly regret to record the death of Mr. O. R. Coales, who had been a Fellow of the Society since 1911, and was well known to its members for his journeys in Western China. He died at Changsha, Hunan, on 26 August 1926, after a sudden illness, at the age of forty-six years.

Mr. Coales had been for twenty-five years a member of His Majesty's Consular Service in China, which he joined as a student interpreter in 1901, and at the time of his death was Consul at Changsha. In the course of his career he undertook several prolonged journeys through little-known parts of Chinese territory. In the late summer of 1910 he travelled across China from east to west, and thence through the provinces of Szechwan, Kansu, and Chinese Turkestan (Sinkiang) to the Trans-Siberian Railway. The record of this journey through a largely unmapped stretch of country was published, with Mr. Coales' route survey, in the *Journal* for February 1912. From 1911 to 1913 he was acting Consul at Wuchow, Kwangsi, and in 1913 and 1914 he was stationed at Shanghai.

In 1915 he was appointed to Tachienlu, in Szechwan, where he was stationed for two years. This post, on the borders of China and Tibet, furnished him with great scope for geographical research, and in the winter of 1916-17 he made a prolonged journey through the little-known country between the upper reaches of the Yalung and the Salween, through the Horpa, Derge, Chamdo, Draya and Markham countries. This journey occupied four months, and in the course of it Mr. Coales was careful to diverge from the beaten track at every possible opportunity, and was accordingly able to achieve many new and valuable results. These results, supplemented by the fruits of his researches into Tibetan folk-lore and the obscure history of the border tribes, were communicated to the Society in a paper read by Mr. Coales on 27 January 1919. The map produced as the result of his survey was published in the *Journal* for October 1919, together with his "Economic Notes on Eastern Tibet."

In 1919 Mr. Coales was appointed His Majesty's Consul at Tengyueh (Yunnan), where he resided from 1921 to 1923. While at this post he did a great deal of travelling on the Burma-China frontier and among the aboriginal tribes of South-West Yunnan, but the results of these investigations do not appear to have been published.

W. S. T.

James Irvine.

By the death, in his ninety-second year, of Mr. James Irvine of Birkenhead, which occurred on October 28 last, the Society has lost a Fellow of fifty-six years' standing. When twenty-three years of age he went out to West Africa, and played some part in its commercial development. He is said to have sent to Liverpool the first consignment of palm kernels from that region, though their value was not at first appreciated. He was also interested in the gold-mining industry. In 1864 he began a West African business in Liverpool, where the remainder of his long life was spent. His sustained interest in the welfare of West Africa was marked in 1903 by the bestowal of a decoration upon him by the President of the Republic of Liberia. Mr. Irvine was the grandfather of Alexander C. Irvine, who lost his life with Mallory on the 1924 Mount Everest Expedition. Mr. Irvine had been a Fellow of the Society since 1870.

CORRESPONDENCE

The Alps of Qungur

ON reading Mr. C. P. Skrine's paper on "The Alps of Qungur" (*Geogr. Journ.*, 66, 1925, pp. 385-411), it has occurred to me that a few notes taken passing through on my way to the North-Eastern Tien Shan in 1906 may be of use to future travellers.

I crossed the Muz Tagh Ata range *viâ* the Chichiklik Pass in the latter part of June, taking nine days (June 15-23) from Tashqurghan to Yarkand.

It will be recalled that in mid-July Mr. Skrine had attempted to approach the Shiwakte range from the south *viâ* the Chichiklik, Yangi davan, and Merki Passes and subsequently reach Yangihissar by the Qaratash gorge route, and had found it quite impracticable owing to the condition of the Merki Pass and flooded state of the Qaratash River. The southern routes, the main Shindi (the winter route), and the Tangitar route, with variations possible at certain seasons, were also wholly impracticable. He was therefore forced to take the route that I also, a month earlier in season, had been forced to take, as the only practicable one, though in my case it, by map, took me a big *détour* to attain my objective, which was Yarkand, where I intended to buy my horses for my further progress to the Tekes-Ili country.

In mid-June the ice in the upper part of the Chichiklik Pass made it very difficult for yaks and horses, they having to be hauled up some places with ropes and all loads packed by hand.

The Chichiklik Alpine meadows below the pass were then mostly under snow, and though only a first showing of the flowers, which have given them their name of the "Flowery Meadows," was to be seen at its lower end, one could well appreciate that later on it would be a treasure ground for the botanist.

I found the passage down the very precipitous gorge leading by Tarbashi to Toi-aul-bulung (Mr. Skrine's Toile-bulung) about the limit of roughness possible for pack-animals, the swollen stream being very violent and the bed a mass of loose boulders.

I had camped one night just below the crest of the Chichiklik, next night at Torbashi, and the third at Toi-aul-bulung, where is the junction of the Yangihissar and Yarkand routes, the latter when practicable. Like Mr. Skrine, I found the two passes crossed on the fourth day, the Tari Art (13,340 feet) and Kashka Su (12,900 feet), without difficulty, and the route beyond simply a matter of hard marching all day long to cover space.

One of the objects of my expedition being botanical exploration, I paid particular attention to the very beautiful flora seen on the alpine meadows at the two passes just mentioned, then at its spring height, obtaining over fifty specimens.

I have no doubt the results, when published by the Kew authorities shortly, will show a similarity to Mr. Skrine's collection. There is a remarkable development in brilliant-coloured varieties of the *Pedicularis* family.

I think the reason for the connection of the flora in this mountain group with that of the Tien Shan and Tibet rather than with the Himalaya is not so much the lofty mountain masses intervening, which would rather tend to form a bridge, as the arid desert-like conditions, the continuous violent prevalent westerly winds and extreme cold due to elevation of the Pamir or southern end of the chain, which surely do form a most effective barrier to all but a few very hardy forms of vegetation.

The most astonishing feature botanically of my journey was the result of

the survey of the low-lying Kashgar basin, the extreme poverty of forms that had been able to establish themselves in this torrid area, their only sources of supply when the former sea disappeared being the highest alpine areas, mountains, and plateaux in the world, extending far and wide around except for one small opening towards the Gobi desert.

My recollection is that I only found some twenty-five or thirty varieties of vegetation established under wild conditions in the entire area, including trees, grasses, and even weeds in cultivated areas. Similarly the magnificent fruit in such abundance at all the oases is without disease; none has ever reached there. On the other hand, the almost daily showers on the alpine meadows of the northern spurs of the Tien Shan have covered the entire country with a rich and beautiful flora, with park-like forests wherever protection from the winds allows, and a rich grass-covering in all open parts that supports unlimited numbers of fine cattle, horses and sheep—the wealth of the Qirghiz.

H. APPLETON, Colonel.

Victoria, British Columbia,
13 November 1926.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

Fourth Evening Meeting, 20 December 1926.—The President in the Chair.

ELECTIONS.—William Adlington; Rev. Richard Alderson, L.T.H.; Capt. E. L. O. Baddeley; Major Archibald George Church, D.S.O., M.C.; Miss May de la Cherois Crommelin; Robert Gordon Evans, B.A.; Harold Herbert Fairweather; Collingwood Ingram; Frederick Dudley Jarvis; Miss Olive Jones, L.L.A.; Lala Sohan Lal, B.A., B.T.; Miss Minty Lamb; Theodore Lloyd; Lieut. Ernest Dettmar Wallis, R.N.V.R.

PAPER: The Fiords of the Hebrides. Prof. J. W. Gregory, F.R.S.

Fifth Evening Meeting, 10 January 1927.—The President in the Chair.

ELECTIONS.—Rev. Charles H. R. Baldwin, M.B.E.; Capt. Norman Robert Burgess; Rev. Maxwell Carnson; Luke Wiseman Cornforth; Dr. L. P. Dame; Capt. G. S. H. R. V. de Gaury, M.C.; Albert Fuller Ellis; Rev. Edward Stanley Fellowes-Farrow, M.A.; A. E. Galloway; Major F. W. Hall, M.B.E.; Harry C. K. Henderson, M.A.; James Holmes, B.Sc.; Miss Marian Horsfall; Donald Hudson Irving; H. F. Lambart; Henry Langworthy; Ernest A. E. Marno; Mrs. Caroline Sabina Melton; Rev. John Herbert Poole; Mrs. Margot Prickett; Sir Edward Denison Ross, C.I.E.; Mrs. Helen Cameron Russell; Lieut. Charles John Shaw-Mackenzie, M.B.E.; Rev. R. Bevan Shepherd, M.A.; Lars Sjestedt; T. H. Stonborough; Hugh Jelinger Symons, B.A.; Miss Gertrude Caton Thompson.

PAPER: A Periplus of the Persian Gulf. Sir Arnold Wilson.

Third Afternoon Meeting, 17 January 1927.—The President in the Chair.

PAPER: Ships of Early Explorers. Mr. G. S. Laird-Clowes.

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THE FIORDS OF THE HEBRIDES

Professor J. W. Gregory, D.Sc., F.R.S.

Read at the Meeting of the Society, 20 December 1926.

THE surface of the Earth is furrowed by valleys of two kinds—those excavated by water, and those due to the rupture of the crust by earth-movements. The Scottish valleys include representatives of both types and display their characteristics especially well where the floors are occupied by the sea. The eastern coast is indented by great firths, which being drowned river valleys belong to the class of estuaries technically known as rias, from those in the north-west of Spain. Between the firths the coast extends in straight or gently curving lines, broken by only occasional inlets and bordered by a few insignificant islets. The western coast, on the other hand, is indented by many arms of the sea, and the land projects in long promontories and peninsulas, and is fringed by numerous islands. These Western Isles or Hebrides vary in size from mere rocks to mountainous islands such as Skye, and they skirt the whole western coast from Cape Wrath to Kintyre. These islands are indented by sea-lochs which have the essential characteristics of fiords, and across the Sea or Gulf of the Hebrides similar fiords intersect the mainland. The sea-lochs are the distinctive features in the geography of western Scotland. The eastern coast is bordered by plains on which are situated the chief towns and ports, and the long belts of sandy links. The western Highlands, on the other hand, are mountainous to the shore, and some of the highest Scottish peaks are familiar landmarks in the voyage along the coast, such as the range from Ben Nevis to Ben Cruachan and Ben Lui as seen from the Firth of Lorne, Ben Lomond from the Clyde, and the less familiar but equally impressive northern peaks, Ben Attow and Mam Soul from Loch Alsh, Ben Dearg from Loch Broom, and Ben More of Assynt from the North Minch. In the western Highlands the chief settlements are at the heads of the lochs or on deltas which have been built out by mountain torrents as at Ullapool. The contrast between the geographical conditions of the two coasts is shown by the distribution of the railways. Along the

eastern coast they run for great distances near the shore. On the western coast, north of the Clyde, the railways reach the coast-line only at the three terminal stations of Oban, Mallaig, and Loch Aish.

The western coast of Scotland is a typical fiord coast. Its inlets



show all the characteristics of fiords, though on a smaller scale than those of Norway. The longer of the Scottish lochs, such as Loch Fyne 45 miles, Loch Sunart 21 miles, and Loch Long 16 miles, are smaller than those of Norway, where Sogne Fiord is 112 miles long. The Norwegian fiords are also much deeper, the Sogne being about 4000 feet

deep, whereas the greatest known depth in a Scottish loch is 1017 feet in Loch Morar. The smaller size of the Scottish fiords is a natural consequence of the smaller scale of the country. The general length of the fiord coast from Cape Wrath to the Mull of Kintyre is only 250 miles, whereas the fiord coast of Norway is over 1200 miles long; the width of the fiord zone in Scotland is 40 miles against as much as 160 miles in Norway; its height in Scotland is mostly less than 3000 feet and seldom over 4000 feet, whereas in Norway there are extensive areas between 3000 and 8000 feet.

The contrast between the eastern and western coasts of Scotland is repeated in other fiord lands, as in that of Scandinavia, between the simple coast-line of Sweden and the fiords of Norway; in America between the fiord coasts of British Columbia and the even shores of Hudson Bay and between the Pacific and Atlantic coasts of Patagonia; and in New Zealand, where the fiords are opposite the smooth coast of Otago. The difference between the eastern and western coasts in Scotland cannot be explained by difference in the rocks, though this explanation was suggested by de Lapparent ('*Leç. Géogr. Physiq.*' (1907), p. 266); for the regular shores of Aberdeenshire and Kincardine are composed of the same kinds of rocks as the indented coast of Argyll. Neither can the difference be explained by the simple theory that the fiord valleys were dug out by glaciers; for glacial action must have been as powerful in eastern as in western Scotland; and the glacial theory of the origin of lake basins is inapplicable, because the fiord valleys and lochs of Scotland were pre-glacial. The ice naturally sometimes flowed along the lochs, but its movement was often across them, and by wearing away the upper parts of their sides it tended to destroy their characteristic features and alter the fiords into ordinary valleys. The independence of the glacial movement from the fiord valleys is shown by the three general glaciation maps of Scotland (A. Geikie, '*Scenery of Scotland*' (1901), p. 306; Bartholomew's '*Survey Atlas of Scotland*' (1912), p. 14; W. B. Wright, '*The Quaternary Ice Age*' (1914), p. 49). The same fact is shown in detail for special areas by many maps; for example, for the area between the Firth of Lorne, Jura, Colonsay, Loch Fyne, and the Clyde, in the map in *Mem. Geol. Surv. Scotland*, No. 35, 1911, p. 61; and for Mull and the Firth of Lorne in *Mem. Geol. Surv. Scotland*, "*Tertiary Geology Mull*" (1924), p. 395, extended by Mr. J. F. Scott to Morvern.

The Hebridean Lochs as Fiords.—That some Hebridean sea-lochs are fiords is shown by their possessing five fiord characteristics. They agree, in the first place, in general form. These sea-lochs, like fiords, are arms of the sea which extend far inland between steep parallel-sided walls; their valleys occur in straight lengths and are flat-floored; they are therefore trough-shaped and are usually free of islands. Instead of the spurs from either side overlapping as in ordinary river-cut mountain

valleys, the spurs are truncated and often show a line of facets on each side of the valley.

Second, the lochs may be of surprising depth. This feature is less marked in the sea-lochs because their deepest hollows have been silted up ; but Loch Morar, only 20 miles long, and now separated from the sea by a narrow barrier, reaches the depth of 987 feet below sea-level. The floor of Loch Ness sinks 701 feet, and that of Loch Lomond 599 feet below the sea.

Third, although deep within, most of the lochs have a shallow entrance, owing to the existence there of a rock ridge or threshold.* Of the thirty-three main sea-lochs on the western coast of the mainland of Scotland twenty-five have thresholds ; and of the eight exceptions, some may only be apparent as the threshold may have been buried under sediment.

Fourth, as the fiords and fiord valleys subdivide inland, and usually at regular angles, and as the branches from adjacent systems often unite, the coast-land is broken up by a network of channels and deep valleys. Massive flat-topped angular blocks are left between valleys which are arranged like cracks in badly shrunk plaster and enamel, and not like the dichotomous branching of river and glacier valleys.

Fifth, the fiord districts are dissected plateaus. This feature is often not recognizable from the sea whence the land may appear an intricate maze of lochs and peaks ; but from the mountain summits the peaks and ridges are seen to rise to the level of the former plateau, and in a dull light, when the valleys are indistinct, the country has the aspect of a wide gently undulating plain.

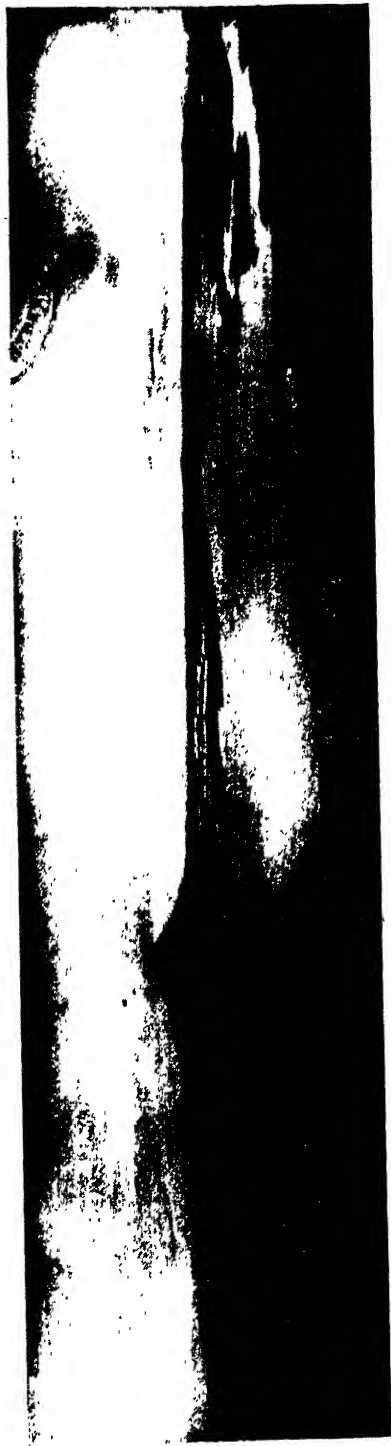
That many of the Scottish sea-lochs are fiords has been recognized in both technical and popular literature. For example, Herbertson ('*Physiogr. Introd. to Geogr.*' (1910), p. 39) described them as "typical fiords." Loch Long has been repeatedly identified as a fiord (as, for example, by Sir Archibald Geikie, '*Scenery of Scotland*' (1901), p. 481 ; and by Goodchild). Loch Hourn is especially impressive from the height of its walls. Loch Seaforth in Lewis shows a combination of fiord characteristics in the straightness of its lower 8-mile reach, its steep parallel sides whence the land rises to peaks of 2622 feet to the west and 1874 feet to the east, its abrupt changes in direction and the T-shaped plan of its inner section.

The fiord valleys are generally continued by land valleys of the same character. The floor may be a low alluvial plain where the sea has been displaced by material washed down by the mountain torrents ; but some of the prolongations are great straths, on the floors of which are long deep lochs. Loch Shiel, for example, though occupied by fresh water, shows all the characteristics of a fiord with its straight course and cut-off

* The threshold has been called a sill, but that term has long had a well-established use in geology and geography.



Lower Loch Seaforth, Lewis : a trough valley



Baval and Loch Eport



Loch Erisort, Lewis : a gutter valley



Loch Boisdale : a fiard

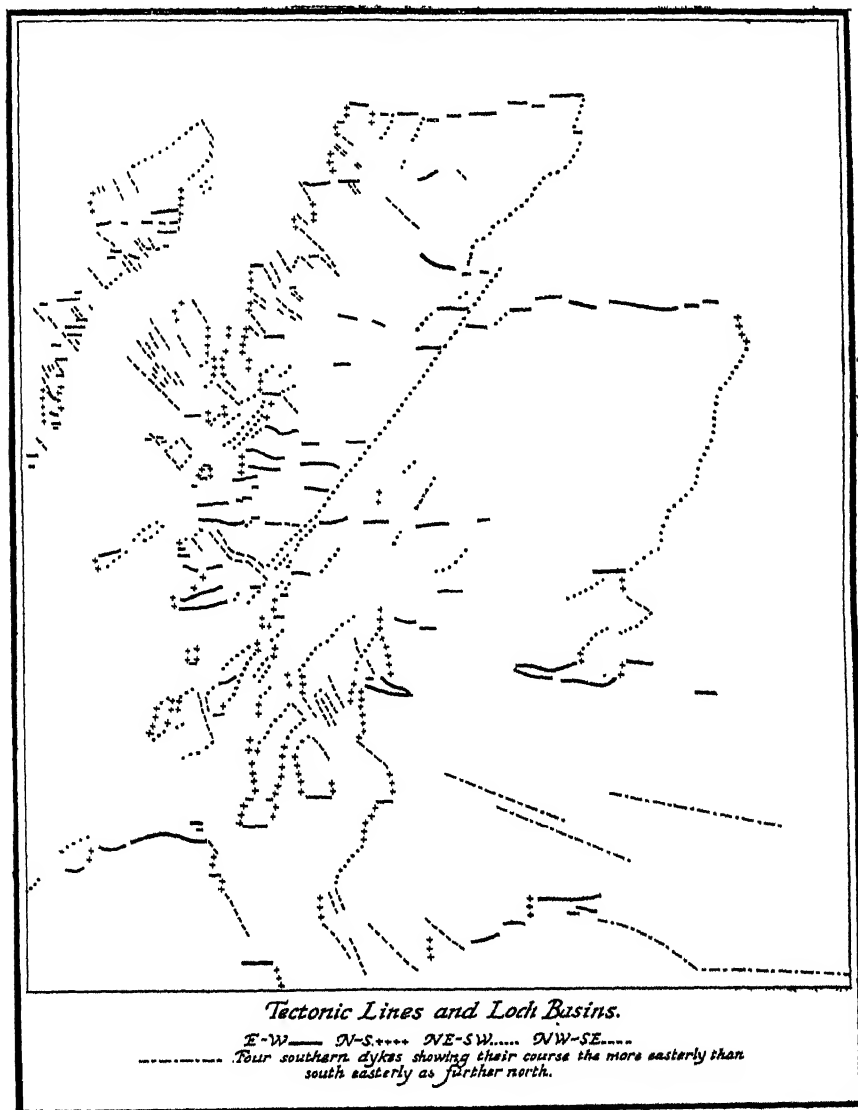
spurs. It was once occupied by the sea, and it would be again converted into a sea-loch by a 40-feet rise of sea-level. The long narrow fiord-like freshwater lochs of Scotland, it should be remembered, are limited to the western side of the country, and are all west of a line passing southward from Inverness across Central Scotland. To the east of that line the only lochs are round pools like the Fifeshire Loch Leven. The picturesque fiord-like lochs, the basins of which have doubtless the same origin as those of the sea-lochs, are all in the western half of the country.

Fiards.—In addition to the fiords there are lochs of two other kinds. One group are fiards, which are so named from the examples on the coast of Sweden. They occur in areas of hard rock, and differ from fiords owing to the low level of the country beside them. Their shores are intensely sinuous and their surfaces are interrupted by many peninsulas and islets. They are intimately connected in origin with fiords, and most fiords would be converted into fiards by submergence; for as the higher parts of the fiord walls are most exposed to denudation they are frayed by branch valleys, gullies, and minor irregularities. Hence if the valley were filled with water to the upper level the ribbon-like band of water would widen out into an irregular sheet with fringed edges and many promontories and inlets. Fiards occur in Norway where the coast happens to be low-lying. They are present at similar positions in the Scottish coast, as at Loch Crinan at the western entrance to the Crinan Canal, around Arisaig on the coast north of Ardnamurchan, and in the Barra Islands and in Lewis among the Outer Hebrides.

Gutter-Valleys.—The third type of sea-loch has a broad and relatively shallow valley with gently sloping sides. These gutter-valleys include the Sound of Mull, which was probably initiated as an old land valley worn out by a river flowing from N.W. to S.E., and Loch Sunart, which was later, in places, betroughed. The main slopes rise in gentle denudation curves to the mountains of Mull on one side and of Morvern on the other. The valley has been deepened and modified by earth-movements, which in the north-western part of the Sound formed the long fault cliffs near Tobermory and to the S.E. of Loch Aline made the precipitous basalt cliffs of Innimore. These cliffs are so recent that a waterfall, in wet weather, leaps from the plateau into the harbour of Tobermory.

Distribution and Orientation.—The main problem in connection with the Fiords of the Hebrides is their origin, and the best clues are their distribution, their independence of the older grain of the country, and their relation to the major geographical features of North-Western Europe. This apparently intricate maze of waterways is based upon a simple plan. The fiords lie along four directions; the two chief series trend N.E. to S.W. and N.W. to S.E.; the two subordinate series trend E. to W. and N. to S. The rectilinear network formed by these four sets of valleys and geographical lines was pointed out in a diagrammatic

map of Scotland in 1913 ('The Origin and Nature of Fiords,' p. 156). This valley system is different from that of the repeatedly converging valleys of ordinary rivers and also, on a smaller scale, of glaciers. It is true that in some countries, where the streams have worked along planes



of weakness due to joints, the bends of the valleys are regular and rectangular; but I know of no case where such joint-controlled drainage has produced, either by rivers or glaciers, a rectilinear network of valleys with basins hundreds of feet below sea-level. It may be urged that the

fiord valleys are due to rivers and ice having enlarged the tectonic rifts by the removal of material which had been weakened by weathering along fractures. The ultimate problem would nevertheless remain, what made the fractures that gave the ice and water the power to excavate the network of fiord valleys?

The regularly arranged valleys due to denudation are dependent on the arrangement of the rocks, as is well shown in England and in the Southern Uplands of Scotland; whereas most of the fiord valleys cross the country utterly regardless of its fundamental geological structure.

The Hebridean Fiord Groups.—The Hebridean fiords may be divided into six groups in addition to two connected with the Firth of Clyde. That Firth is itself a ria, being the submerged western part of the Midland Valley of Scotland. The outer firth, a normal ria, presents a striking contrast to the trough-shaped fault-valley between the old rocks of Cowal to the west and the lava hills of Renfrewshire. The two parts are connected by the portal of the Inner Firth between Cumbrae and Bute. Still further north one branch of the valley continues across the Highland Boundary Fault as Loch Long, which, being deeply trenched and having its faceted spurs cut off along the same line, presents typical fiord characteristics. Further west other fiords indent southern Cowal along the Kyles of Bute, and the deep valleys which continue them inland often disappear northward in the mists of the Southern Highlands.

The second or Loch Fyne group begins to the south along a great fault which forms the eastern front of the peninsula of Kintyre and crosses Northern Arran. When seen down Loch Fyne from Ardrishaig, Arran takes its place as part of the south-western side of this fiord. At Ardrishaig the fiord turns abruptly to the north-east, and the south-eastern wall is so straight and smooth and with such a level edge where it joins the plateau, that it has the aspect of a colossal railway cutting. This type of scenery, which is widespread in the Scottish fiord valleys, is redeemed in interest by the variable and ever-attractive sea, and by the beauty of the atmospheric and colour effects. This even-walled upper part of Loch Fyne is roughly parallel with the strike of the rocks; but the loch is slightly oblique to the strike, and appears to have been formed along faults which though they followed the general grain of the country diverged from it in places. At Ardrishaig the loch turns at an elbow and it cuts boldly across the strike of the rocks. Loch Fyne—owing to the parallelism of its walls, its long straight edges, its angular changes of direction, the well-marked threshold at its mouth, and its independence in course of the structure of the adjacent country—has all the essential characteristics of a fiord.

The third group occurs along the western coast of Kintyre as far north as Loch Crinan; it includes the Sounds of Jura and Islay, and those between the adjacent islands. The larger sounds, such as those between Jura and Islay, are fault-formed; the fault along the north-

western coast of Jura is continued by the straight southern end of Shuna Island and by the fault that separates the two granite masses south of Loch Melfort. The geological structure of the Sound of Islay indicates its formation by parallel faults. The mainland opposite Jura is deeply indented by West Loch Tarbert, Lochs Killisport, Swin, and Crinan, which have very sinuous shores and are typical fiards. They indicate that the faulting of Jura Sound left Jura with a long straight scarp while the subsidence gave the mainland a drowned topography. These fiards and channels are pre-glacial, as most of them lie across the direction of the ice that flowed from the eastern mountains.

The fourth group consists of the Firth of Lorne and its continuation Loch Linnhe, and Strathmore, the valley and chain of lochs followed by the Caledonian Canal to Inverness. This valley is the longest fiord in Scotland. It lies along a north-east-trending fault, which is later than the youngest rocks along it. That the faulting is even later than the volcanic period is indicated by its relation to the basalt dykes. The country on the north-western side of the valley has been lowered by the fault movements; for the lochs and deep valleys which pass off to the west and north-west, including Lochs Eil, Arkaig, and Garry, and Glens Moriston and Lewiston—may be regarded as the estuaries of rivers from the north-western highlands. There is nothing on the eastern side, north of Loch Leven, to correspond to these lochs and valleys. The subsidence of the north-western side of Strathmore is also indicated by Mull, where the older rocks, which rise to the height of 2400 feet east of the Sound of Mull, are confined to relatively low levels and are now exposed in the foundation by some buried peaks.

The lochs of the fifth or Mull group are arranged partly in concentric and partly in radial series. The remains of three concentric series occur on the eastern side; but on the western side, owing to the wider submergence of the area between Mull and the outer islands, there is now but one broad channel. Of the circular series the innermost includes the outer part of Loch Sunart, its tributary Loch Teacuis, the fresh-water Loch Arienas, Upper Loch Alinc, the fault band near Innimore, and in south-eastern Mull, Lochs Spelve and Buy, and on the western side the channels between Mull and the Treshnish Islands. The second concentric series includes the inner part of Loch Sunart, Loch Linnhe, the Firth of Lorne, and the channel between the Treshnish Isles and Coll. The outermost concentric series passes north of Ardnamurchan and through the Sound of Arisaig, is continued by Loch Ailort, Loch Eil, and Upper Loch Etive to Loch Awe, and goes by the pass from the head of Loch Awe to Craignish and so to the strait of Corrieveckan. These concentric series are traversed by radial fiords, some of which break the western coast of Mull into a trident of peninsulas; the northern coast is indented by Loch Cuan, and the eastern side by the conspicuous Glen Tulla; and farther afield the radial valleys are occupied by Lochs

Creran, Lower Loch Etive, and Loch Feochan. The arrangement of the Mull group is due to the volcanic activity, which strengthened the foundation of the island and therefore diverted the fractures from the normal course into a concentric peripheral series with some minor radial fractures.

The sixth or the Skye group agrees in general plan with that of Mull. The central mass of Skye was also the deep-seated core of an ancient volcano; and Skye is surrounded by a ring of peripheral sounds and lochs, including the Sound of Raasay, the Kyle of Loch Alsh, the Sound of Sleat, the Cuillin Sound to the south, and the Minch to the west. This series, like that of Mull, is broken by radial fractures including the famous Loch Coruisk on the southern side of the Cullins, and the large lochs of western Skye, and on the mainland, upper Loch Torridon, Loch Kishorn, Loch Carron, Loch Alsh, and the magnificent fiords of Loch Duich, Loch Hourne, and Loch Nevis, which are opposite to south-eastern Skye.

The seventh series extends along the north-western coast of Scotland from Loch Torridon to Cape Wrath and for a little distance eastward along the Pentland Firth. On the western coast there are seven chief lochs which trend from W.N.W. to E.S.E., and four, with the upper part of another, which trend from E. to W. From the Pentland Firth four lochs run inland to S.S.E. This belt of Scotland includes the oldest of British rocks, and also a band of quartzite and limestone which is parallel to the general direction of the coast. The lochs cut across the grain of the country, which is indicated by the quartzite and limestone, at the angle of typically about 105° . The lochs from the Pentland Firth are approximately parallel to the strike of these rocks, and Loch Erribol lies along it. Some of the lochs, such as Loch Maree and part of Loch Ewe, and the lake, Loch More, occur on cross faults through the quartzite and limestone band. Basalt dykes, trending north and south, extend as far north as Loch Torridon; but further north none are known on the mainland though they occur in Lewis as far north as Stornoway. This group of lochs is therefore outside the area of the volcanic disturbance, and the lochs show one of the simplest expressions of the torsion fracture of western Scotland.

The eighth group is that of the Outer Hebrides, in the islands of Lewis-Harris, the Uists, and the Barra Isles. The loch series begins in the north with the broad valleys of Loch Erisort and Loch Resort, which with some intermediate fresh-water lakes form a broken line across Lewis trending approximately S. of W. to N. of E. South of this belt are the fiord valleys of lower Loch Seaforth and Loch Claidh, which trend from N.N.W. to S.S.E.; W. of them the mountains of the Forest of Harris are cut through by steep parallel-sided valleys, which are only not fiords as their floors are above sea-level. Further south in Harris the lochs trend N.W. as do the southern coast of the island and the geographical features in

North Uist around Loch Maddy. Then the course of the lochs and valleys lies E. to W., as seen in Loch Eport and Flodday Sound. Still further south the direction becomes W.N.W. in and on both sides of Benbecula. In South Uist a N.W. trend holds in the upper parts of Lochs Skipport, Eynort and Boisdale, and E. to W. in their lower parts. The sound between South Uist and the Barra group also lies E. and W. ; but in the Barra Isles the directions W.N.W. to E.S.E. and W. to E. are both well developed.

The most remarkable feature in the fiords of the Outer Hebrides is that they cut right through the mountains. In Harris and South Lewis the upper part of Loch Seaforth once discharged along an E. to W. gutter-valley, but the drainage was diverted to the S.S.E. by the fractures through the mountains of Harris that made the middle and lower sections of Loch Seaforth. Similarly the mountain chain of South Uist has been broken through by Lochs Boisdale, and Eynort, which have diverted some of the western drainage to the Minch.

That the deep depression of the Minch was due to subsidence between faults was suggested by Sir Halford Mackinder ('Britain and the British Seas' (1902), p. 75). He remarked, "The suggestion is irresistible that the Minch is a submerged rift valley with collapsed floor, fault bounded." This view also has the support of Heddle, 'Geological Features of Outer Hebrides,' Harvie-Brown and Buckley, 'Vertebrate Fauna of the Outer Hebrides' (1888), p. 228.

That the Minch was thus formed is shown by various lines of evidence : for example, the lavas of western Skye slope upward till they end abruptly at steep cliffs, as if the rocks had been part of an arch of which the western side has foundered beneath the sea. Fractures connected with the formation of the Minch probably cut through the mountains to the west and formed the main sea-lochs of the Outer Hebrides.

The Orientation of the Fiords independent of the Geological Structure.—The orientation of the Hebridean fiords is not only remarkably regular, but is in the main independent of the older geological structure of western Scotland. In topography due to denudation the rocks which resist decay stand out as ridges and those which crumble more readily are cut down into valleys. The relief of a country is usually an expression of its structure. But in the western Highlands the fiord valleys cross the country regardless of the grain. The valleys are no doubt in places diverted along it, just as in the rupture of a piece of wood branch cracks tend to run for a short distance along the grain ; but the direction of the Scottish fiords as a whole is quite independent of the fundamental structure. The dominant grain of north-western Scotland trends from N.N.E. to S.S.W., from Cape Wrath to Skye. The strike of the oldest rocks, the Lewisian gneiss, is almost at right angles to the other direction, being from W.N.W. to E.S.E. Some of the lochs, such as Loch Laxford, are approximately parallel to the Lewisian strike ; but

where the grain of the country is determined by the younger sedimentary rocks the lochs cross it sometimes at right angles, and commonly at the angle of about 110° , as at Loch Broom. In the southern Highlands the usual grain of the country trends from W.S.W. to E.N.E. Some parts of upper Loch Fyne are approximately parallel to this direction, but in some places the two are oblique. The loch south of the right-angled bend near Ardrishaig cuts across the grain at an angle of about 116° . As the course of the fiords is not determined by the grain, the fiord-producing agency was so powerful that it cracked the country like a slab of glass, and was so recent in its action that many fiords are still bounded by straight scarps.

Tension-clefts.—The fractures associated with the fiords are of different sizes and patterns. They vary from mere cracks to wide passages, and from approximately parallel series with occasional bifurcations to widespread networks. Soft beds and weak rocks when crumpled yield by bending, whereas hard rocks yield by the opening of joints and the formation of tension clefts. In country folded into an arch the clefts are mostly long and parallel to the axis of the arch, though with perhaps some bifurcations at low angles. Around domes and basins most of the tension clefts are marginal and concentric to the centres of movement, and are crossed by others at right angles or at wide angles. Where a country has undergone torsion it is torn by intersecting diagonal fractures, and tension clefts of this kind are conspicuous in most fiord fields. They are shown in Greenland in a sketch by Kornerup (republished, 'Fiords' (1913), p. 266) showing the control of coastal outlines by joints. I have also reproduced (*ibid.* p. 101) a sketch by Brogger showing parallel clefts in the rocks of Norway, 50 miles west of Oslo (Christiania). Similar tension clefts may be seen in all parts of the western Scottish coast. They produce long straight gullies which cross the hillsides independently of the structure of the rocks; they sometimes give off branches at a regular angle, or are crossed by similarly arranged gullies. Some of these clefts break the rocks into large blocks by spaces which are broad above and taper downward. The smallest clefts are narrow joints, from which all stages can be traced through conspicuous clefts that are enlarged by the decay of the rocks, to gaps that at once admitted the local streams, and have been widened by their action. The clefts sometimes pass unbroken through different rocks, and are so crowded that they cannot be due, like ordinary joints, to a cause acting from within the rock; they are the result of some external wide-acting stress. In other places the clefts are less numerous, but broader, and they form passages wide enough for footpaths and roads.

Attention has often been called to the importance of the tension clefts in the development of Scottish topography.* The evidence is

* In some cases these clefts are due to weathering along dykes, along bands of weak rock, and along older joints. In many cases, however, clefts occur where there

most direct in the case of young narrow clefts such as some of the slocs and geos of the Outer Hebrides, which have been described by Prof. Jehu and Mr. Craig (*Trans. R. Soc. Edinb.*, 53, 1924, p. 421; 54, 1926, p. 469); also the goes of Caithness, and the gja or gjovs or geos of the Faroes, to which Dr. Peacock has called attention as showing the method of fiord formation in the Faroes.

Three Structural Types of Fiord Valleys.—The fiord valleys may be classified by the nature of the earth-movements that made them into three divisions. First, those due to the sinking of a strip of land between parallel faults, forming a rift valley, such as the Sounds of Sleat and Islay. Second, those due to the shattering of belts of rock by many tension clefts, and the removal of the broken material by wind, water, and ice. Kerrera Sound was thus formed, though it looks at first sight like a fault-bounded valley; but the cliffs beside it at Ardbane, south-west of Oban, are due to a tension scarp; for the evidence along the shore is conclusive that no major fault happened there, though the rocks are traversed by many minor faults with a throw of only a few inches. Some of the tension clefts beside Kerrera Sound have been filled by quartz veins and are seen in rock exposures at Oban. There is no absolute proof of the date of these quartz veins, but as they are parallel to the Sound they probably date from its formation. Similar young quartz veins parallel to the fault along the western side of Loch Fyne near Tarbert have been mapped by Mr. W. J. M'Callien.

The third type of fiord valley is due to the subsidence of a strip of country against one major fault, producing an asymmetric valley between a straight fault scarp on one side and a fiard coast with a fringed irregular shore-line on the side that has sunk. This type of tectonic valley is common among the Scottish lochs, as at Loch Linnhe and the Caledonian Canal, Loch Lomond, Loch Maree, and Loch Eport in North Uist. The Sound of Jura represents this type superposed on a rift valley owing to a renewed movement on the south-eastern side.

The Age of the Hebridean Fiord Valleys.—The determination of the cause of the fiords is complicated by the uncertainty as to their age, owing to the lack of fossiliferous rocks which would supply a time scale. In their absence the Scottish chronology of the latest or Kainozoic Era is dependent upon two great geographical revolutions—the first volcanic and the second glacial. The volcanic eruptions at Mull and Skye built up volcanoes as high as Etna, while later, in the glacial period, Scotland was covered by an ice-sheet even more complete than that of Greenland. The age of the eruptions is uncertain. The only fossil evidence from Scotland is from some plant beds in volcanic ash at Ardtun in Mull. The Geological Survey follows Mr. Starkie Gardner in regard-

are no dykes; they cut across the structural planes of the rock, and across the older joints. Such clefts have clearly been developed along fractures later than the volcanic period of Western Scotland.



Kerrera Sound



Loch Crinan and Scarba Fiard



Normal type of E.-W. valley with Loch Sunart in the old gutter valley



Morvern plateau with Loch Sunart in trough valley



Looking across Loch Linnhe to the wind-gap at the head of Loch Sunart in the E.-W. valley from Loch Tummel to Mull

ing them as Eocene and as possibly Lower Eocene. That view has the high though tentative support of Prof. Seward. The British Eocene climate was however tropical, as is shown by the palm groves that flourished in the London and Hampshire basins. The plants associated with the volcanic rocks in Mull indicate temperate conditions. The plant evidence is admittedly weak, for not one of the plant genera represented is distinctively Eocene, and an associated fossil beetle and a doubtful nut favour an age long after the Eocene. It is therefore likely that the original view of these plant beds being Miocene may be correct.

The last stage in the volcanic history was the injection of molten igneous rock into the cracks and fissures around the volcanic centres. This rock has solidified in dykes which are now conspicuous features in Hebridean scenery, for some of them stand out with the distinctness and regularity of artificial walls.

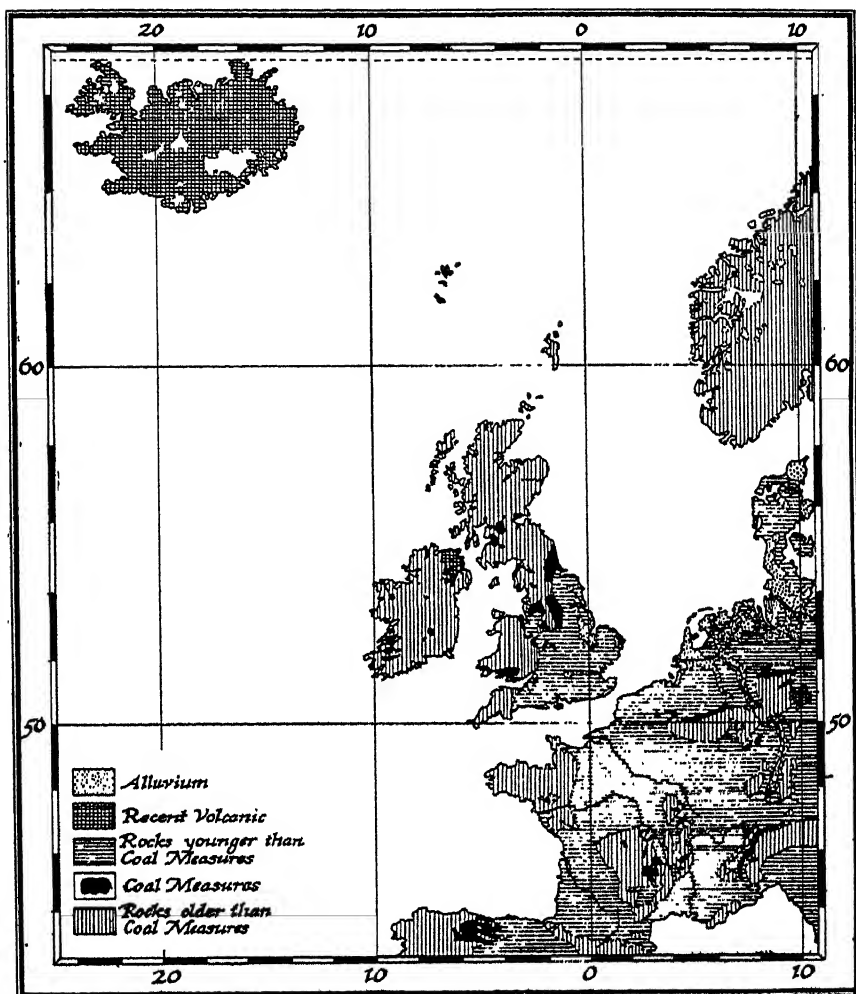
These dykes belong to two main series. Those of one series, as east of Oban, trend E. and W. ; and they appear to be older than the members of the second series, most of which trend from N.W. to S.E. These north-westerly dykes occur in great swarms. One swarm passes through Mull and south of Oban. The dykes are sparser on both sides of this band (*Geol. Surv. Scotland*, Mull (1924), p. 357) ; but a second swarm with the same trend passes through Islay to Arran. A few of the dykes in the swarm of eastern Mull intersect the others at angles often seen in the intersection of the fiord valleys. Farther north, as near the Gairloch, the dykes of this series run N. and S.

To the N.E. of the swarms the dykes are less numerous, and none belonging to the volcanic period is marked on the Survey Maps on the mainland north of Loch Maree. In the Outer Hebrides, however, they occur in Lewis even farther to the north. The special significance of the dykes is that they show that the fiord valleys are later than the volcanic period, and are independent of the early systems of dislocations. The dykes are seen at sea-level and on the mountain-tops. If the valleys had been in existence when the dykes were injected the molten rock would have been discharged along the floors of the valleys and would not have reached the mountain summits. At the close of the volcanic period the surface of Scotland must have been above the level of the highest existing mountains.

The fiord valleys are therefore post-volcanic. They are also pre-glacial, for the ice filled them and like a vast vacuum cleaner scoured them and swept away all their loose material. The ice planed and smoothed the slopes of the valleys and cut back some of the spurs ; but the valleys and major basins were all in existence before the ice flowed into them. The formation of the fiord valleys was therefore intermediate between the volcanic and glacial epochs.

Relation to the Alpine Folding and Atlantic Subsidence.—After the close of the volcanic eruptions Scotland was worn down into a plain

sloping gradually to the south and south-east. This plain continued across England and reached the sea in the southern districts, when the land was at least 600 feet lower than at present. According to Dr. Mort, the platform at the height of between 1000 and 1200 feet in Arran was sea-cut; and if so that part of Scotland was more than 1000 feet lower

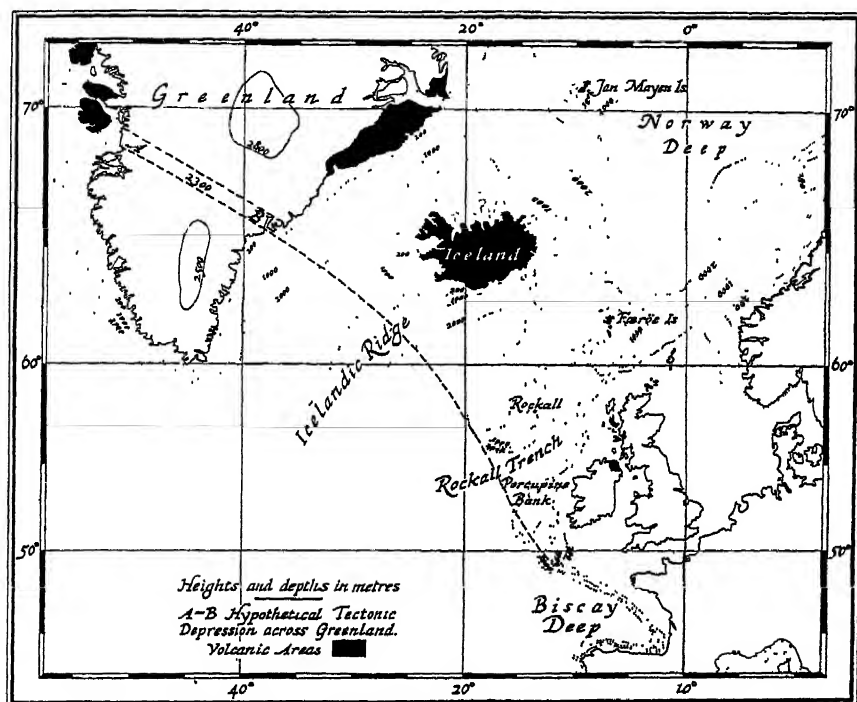


Geological sketch-map of Western Europe

than it is at present. Further north the old plain is from 1400 to 1600 feet above present sea-level, and represents an uplift of that amount.

The volcanic period found Scotland with various ranges and valleys trending E. and W. In the S.E. of Mull, for example, a ridge of gneiss with that trend was smothered by the volcanic eruptions. After the volcanic period many further ranges and valleys with the same trend

were formed and play an important part in the form and relief of the country, as through the northern Highlands the high ground occurs in long E. to W. plateaus separated by valleys. This later E. to W. relief was probably one of the secondary results of the Alpine movements. To the north of the intensely disturbed band which had been upheaved as the Alps and Pyrenees, a series of gentle crustal waves folded the country along lines trending E. and W. The movements not only affected the present area of Europe, but doubtless extended westward and there



Tectonic depressions in the North Atlantic

left the crust so unstable that the Atlantic was greatly enlarged and deepened by the subsidence of parts of western Europe and of the sea floor. Such subsidences are usually attended by volcanic activity, and the North Atlantic subsidences were associated with volcanic eruptions in Ireland, western Scotland, the Faroes, Iceland, and both sides of Greenland. The boundaries of the major subsidences are shown on the orobathymetric charts of the North Atlantic; and the steep slopes which bound the main deeps are parallel to the Hebridean fiords. The major slopes range N.W. to S.E. and N.E. to S.W., and two subordinate series trend the one E. and W. and the other N. and S. The subsidences which made these slopes inevitably produced planes of weakness in the adjacent lands.

The parallelism of the fiords and of the tectonic lines of the North Atlantic may be seen, to quote an easily accessible authority, from the bathymetric map of the North Atlantic basin, in the 'Times Atlas' (Plate II.), and in the figure herewith, prepared from the Prince of Monaco's 'Carte général bathymetrique des Océans.' One set of the oceanic structure lines trend E. to W., such as the southern slope of the Biscay deep, which was probably due to a subsidence on the northern side of the Pyrenean folds. The E. and W. lines in the British Isles include the arch of the Weald over the south-eastern counties, the uplift across Lancashire and Central Yorkshire which separates the South Yorkshire from the Northumberland and Durham coalfields, and farther north the southern shores of the Moray and Pentland Firths; also the numerous E. and W. straits between the Hebrides, and the valleys which have divided the highland plateau into many E. and W. bands.

The second lines run N. and S. One of them determines the western coast of Spain; west of Ireland this line is irregular, as it crosses the E. to W. structures, but farther north it is steep and straight where, as the western edge of the Vidal Bank, it forms the eastern side of the trench between Britain and Rockall. Meridional lines are also conspicuous on the western side of the Rockall Bank, and bound the Norway Deep in the Arctic basin between Iceland and Scandinavia. The British Isles rest on a shelf which sinks gradually to the depth of about 100 fathoms and is cut off to the west by the subsidence that made the trench between the Vidal Bank and Rockall.

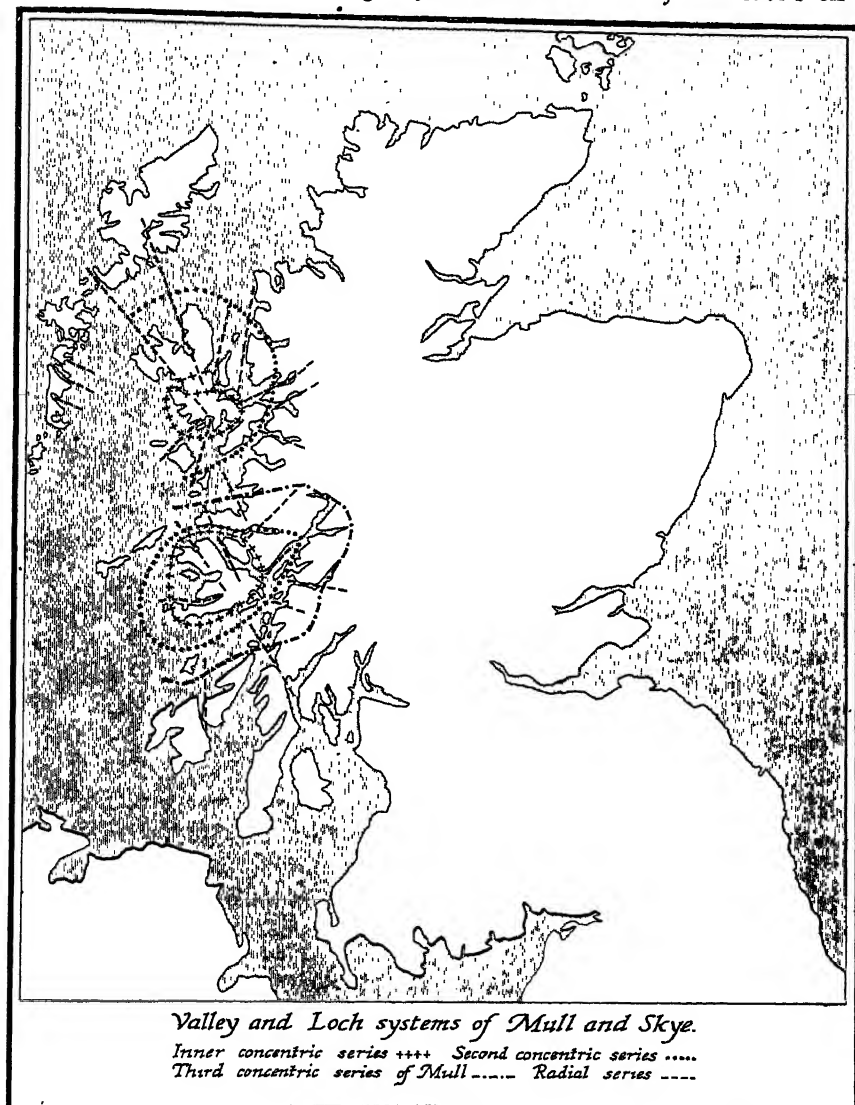
The subsidences at first ruptured long belts of western Scotland along close parallel lines, trending in the main from N.W. to S.E. These fractures happened during the closing stage of the volcanic period, and they were injected by molten basalt, and thus gave rise to the dyke swarms. The fractures were mostly parallel and were in strips of country that had been broken between faults. The parallelism of most of these dykes show that they were formed while the country was subject to widespread even tension.

The earlier of the Atlantic subsidences were bounded on one side by a N.W. to S.E. line from Greenland to the Bay of Biscay (Fig., p. 207); and along the parallel fractures in the land to the N.E., volcanic eruptions built up the volcanoes of Greenland, Iceland, the Faroes, the Hebrides, and Antrim. The last stage in this volcanic period was the injection of the dyke swarms; most of the dykes had a N.W. to S.E. trend, and a few of them reached as far south as the north of England. Later Atlantic subsidences on N.E. to S.W. lines broke up this volcanic belt, separated Iceland from the Faroes, and separated Rockall and the Faroes by the Faroe Trench and the Rockall Trench; and also formed and enlarged the Norway Deep to the east of Iceland and north of the British shelf.

The formation of these depressions to the north of Scotland on N.E.

to S.W. lines, while the foundations of the country were still weakened by the N.W. to S.E. fractures, altered the stress on Scotland from a simple bending on a N.W. to S.E. axis to a torsion along a N. to S. axis.

The torsion of a slab of glass, as is well known by Daubrée's ex-



periments, produces intersecting cracks inclined 45° to the axis of torsion. The torsion of the Hebridean belt by the Atlantic subsidences would have produced two series of diagonal fractures, one trending N.W. to S.E. and the other N.E. to S.W. These two directions are the most widely developed in the Scottish fiords. The N.W. to S.E. lines also

occur throughout the north-eastern Atlantic, as in the northern boundary of the Biscayan Deep. The N.E. to S.W. lines bound the deep trench which runs from the Norway Deep between the Faroes and the Shetlands and the long rise which extends for 600 miles S.W. from the south-western corner of Iceland. In the Hebrides and throughout the Scottish Highlands these two directions are the most conspicuous in the geographical structures.

In the Hebrides there are however two interruptions in the regular network of the fiord valleys due to two resistant blocks which have diverted the fractures, just as cracks in a piece of wood are stopped or diverted by knots in it. The injection of the foundations of the volcanic centres, Mull and Skye, by molten rock material has strengthened them, like grout forced into the cracks in the foundation of a building. The reinforced masses beneath Mull and Skye resisted fracture, and led to the development around them of marginal concentric valleys, of which three series can be recognized around Mull, with some radial valleys which are occupied by the sea on the western side of Mull and form deep land valleys on the eastern. Skye is similarly surrounded by a zone of marginal subsidences with valleys radiating from it like spokes; though Skye, being nearer the margin of the Scottish platform than Mull, has the concentric series less well developed.

The relation of the British Isles to the Atlantic slopes appears to control the distribution of the later tectonic features. South of the Highlands the British platform projects westward far beyond Ireland, and the southernmost of volcanic areas, as Dr. Tyrrell has reminded me, is the Porcupine Bank 150 miles west of Ireland, and due south of Rockall. Southern Scotland and England being protected from the Atlantic movements by Ireland and the shelf around it, the southern fractures due to those movements change in direction. The dykes turn from their course to the S.E. till they pass across northern England on lines almost W. to E. Similarly in southern Scotland, though that N.E. to S.W. direction which is predominant in the topography of north-eastern Scotland still holds around the Sound of Jura, the greater strength of the E. to W. influence is there manifest by the westward curve of the Loch Tarbert in Jura, and of some of the lochs on the mainland and in Mull.

The sequence of events as interpreted in this paper is summarized in the following table :

SEQUENCE OF EVENTS IN THE FORMATION OF THE HEBRIDEAN FIORDS
Pleistocene. Scottish glaciations and moulding of the pre-existing fiords.

Upper and Middle Pliocene.	} Uplift of the British Isles.	{ Formation of the fiords and the Scottish loch basins by diagonal and meridional fractures with fresh faulting. Formation of the later E. to W. valleys and geographical lines.

Lower Pliocene.	{ Subsidence below sea-level in southern England ; extended Atlantic subsidences breaking up the volcanic belt of Iceland, the Faroes, and the Hebrides on N.E. to S.W. lines, producing torsion and diagonal fractures in Scottish area. Scotland subsequently reduced to a S.E. sloping plain.
Upper Miocene.	{ Subsidence in N.E. Atlantic on N.W. to S.E. lines, with volcanic eruptions on the border of the sinking area from the Hebrides to Iceland and Greenland. The volcanic period in the Hebrides closed with the dyke swarms, on N.W. to S.E. lines. Climate temperate, with fossils of Upper Kainozoic affinities.
Middle and Lower Miocene Oligocene.	{ Main Alpine and Pyrenean folding. British area continental and gently folded on E. to W. axes.
Eocene.	{ Climate in England tropical. Prolonged denudation of Scotland removing, before the volcanic eruptions, all but small patches of the once extensive Cretaceous deposits

The fiords of the Hebrides, like the sea-lochs and fresh-water lochs of western Scotland, may therefore be included among the indirect effects of the Alpine upheavals and Atlantic subsidences. The first stage in the development of these fiords was the folding of the country during the uplift of the Alps and the Pyrenees when Scotland must have been part of an extensive and continuous land, as the Scottish geographical features then produced were on parallel lines which trend E. and W. The compression due to this folding was followed by a reaction which led to the formation of tensional fractures and extensive subsidences in north-western Europe and the adjacent region to the west of it. These subsidences were accompanied or followed by volcanic eruptions and by the fracture of the country on lines which were predominantly from N.W. to S.E. ; and as the subsidences approached the Scottish area it was weakened and subject to torsion along an axis aligned approximately N. and S. This twisting produced intersecting diagonal N.W. to S.E. and N.E. to S.W. fractures.

In the Pliocene period the British Isles were slowly uplifted. The uplift opened up the fractures and caused them to gape until they were wide enough to capture the drainage in the highlands and let in the sea on the lowlands. Surf along the shore and rivers and glaciers inland widened the clefts and valleys ; and as they were made in the Pliocene they have inevitably been greatly modified by the ordinary geographical agencies ; but the plan of the valleys, and the places where the fracturing led to the deep shattering and decay of the rocks and therefore to the formation of deep basins, were due to the combined effect of the Alpine disturbances and the enlargement of the North-Eastern Atlantic by the foundering of the adjacent land and of its floor. The fiords were therefore due to the rending of the crust during and after the Alpine earth-movements, and to the subsequent gaping of the fissures during the Pliocene uplift of the British area, which was probably three

times as great in Scotland as in southern England. The charm of the fiords as we see them to-day is due to the healing agencies of Nature, which have diversified and moulded into lines of beauty the straight scarps and featureless walls made by fault and fracture.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: Professor Gregory of Glasgow, and of many other places before that, is so well known to this Society and has either spoken to it or written to it on so many occasions that he needs no introduction from me. He is going to speak to-night about a region very much nearer home than those of which he has sometimes spoken before, but a region to which he has devoted a very great deal of care and attention. Those who were privileged to hear Professor Collet's paper in December last will realize what an immense interest attaches to the lake basins of Scotland as well as to the lake basins of Switzerland. I will now ask Professor Gregory to read his paper on the Fiords of the Hebrides. "The Hebrides," I may say, in this case is intended to include the fiords on both sides of the Hebridean Sea; that is to say, the fiords which run up into the west coast of Scotland as well as those which run up into the islands of the Hebrides.

Professor Gregory then read the paper printed above, and a discussion followed.

Sir JOHN FLETT (Director-General, Geological Survey of Great Britain): Professor Gregory's lecture is of intense interest to all who study the origin of British scenery and surface features. Perhaps his subject is one of the most controversial of all subjects concerning the development of British topography. The history of the fiords has been bitterly fought upon by Scottish and English geologists and geographers for more than sixty years, and, as I see by Professor Gregory's lecture, it is not yet by any means settled. Professor Gregory is an English geologist resident in Scotland. I am a Scottish geologist resident in London. Between the English and the Scotch on this subject of fiords there has always been, as we say in Scotland, "a bout." While I am prepared to accept a very great deal of what Professor Gregory has laid before you; to recognize that he has taken a broad and philosophic view of the subject of discussion, and to thank him for the manner in which he has placed the facts before us, yet there are certain points on which I crave permission to reserve my opinion.

Speaking generally, there are two methods of approaching this interesting little problem. One of these is to emphasize as far as possible the importance of Earth-movements and fractures, and I understand that Professor Gregory takes his stand upon that line: that he considers that Earth-movements, particularly of recent Tertiary times, have decided very largely not only the distribution but also the central features of Scottish landscape. The other line is, while admitting the importance of Earth-movements and lines of dislocation, to insist upon the immense importance of recent glacial erosion, so that the features of Scottish fiords are ascribed largely to the gnawing action of flowing glacial ice along lines of valleys which must have been pre-existent and which had an origin in the nature of the rocks in which they occur: to say that without ice you will not get fiords, and that the essential features of fiords are due to ice-action plus tectonic features.

While in close agreement with much that Professor Gregory has said, I would submit that fractures do not determine fiords. For the existence of fiords we need not only a definite system of volcanic fractures but a definite

cause of erosion, and that cause is partly running water, which decides the erosion of this system of fractures. For the ultimate configuration and sculpture of the fiords no agent seems to me to supply such effect as the action of flowing ice.

No one who studies the map of Scotland, and especially the West of Scotland, can doubt the reasonableness of Professor Gregory's main contention, that the lineaments, so to speak, of Scottish geography along that coast are very clearly defined by a series of fractures running in definite directions. We Scottish geologists who have been working patiently over the surface of Scotland year by year, mapping it sheet by sheet, recognize that there are at least four sets of fractures, each characterized more or less by its definite direction, and each set of fractures appearing to have been accompanied by a series of igneous intrusions in the form of dykes. On the north-west the pre-Torridonian; north-east, early Devonian, still moving in some cases; east and west, late Carboniferous; and north-west, Tertiary. All these, under certain circumstances, have been effective in the development of straight, steep-sided valleys and lochs. Some of the great fiords run north-west; some south-east, but the east-and-west fractures are not so pronounced as the north-west and south-east fractures.

Professor Gregory seemed inclined to ascribe to movements in Tertiary time the opening of the series of fissures along which erosion very rapidly took place, and suggested that by the submersion of these eroded valleys the present deep-sea fiords were formed. There is a great deal of truth in the contention, because in Skye and Rum and Mull we have those north-west lines of cracks deeply eroded, filled with water, forming fresh-water lakes or arms of the sea; and where there are arms of the sea formed there are typical fiords. There are in Mull a whole series of north-west fractures, many of them filled by igneous rock, and along these lines of fracture very deep lochs, eroded, so far as I can see, by glacial action. Where these lochs emerge upon the sea, fiords result. It seems to me from a study of that particular country that without glacial action there could be no fiords.

The characteristics of fiords, as Professor Gregory has stated, are their straight coast, their recticular arrangement, their great depth and vertical sides, and often also the presence of the sill or doorstep or threshold at their mouths over which the water in the interior may communicate with the water outside. All these features, except perhaps the doorstep, might be fairly well explained either by subsidence or by erosion along the lines of dislocation. But we have to remember that wherever fiords occur there is evidence of very intense glacial erosion, and that the great development of fiords in Scotland takes place in the district where the evidence is that the glaciation was most active and vigorous. We do not get fiords on the east side, but on the west. It would take too long to explain that now. Let me merely say that the watershed is near the centre; that for many reasons the glaciation of the west of Scotland has been more intense than on the east of the watershed and, although in some districts the fiords lay across the main lines of movement of the ice-sheet of the period of maximum glaciation, there is often proof that the deep valleys served as channels along which a current of ice flowed during a long time.

Professor Gregory has shown a map by which it is clear that the lines of the fiords in many cases are transverse to the lines of glacial travel. That is very true, but I do not think it is the whole truth. We geologists who have been working largely in the south-west of Scotland know that while the superficial ice frequently flowed over the surface, the deep valleys or troughs were filled with ice flowing along the deep channels, and where there is ice flowing freely in such channels there will be erosion, which will generally leave its mark.

Sir HALFORD MACKINDER: At this hour of the evening I do not propose to enter into a controversy, the first battle of which has been fought in your presence. We have already had an intimation from the Director of the Geological Survey that he does not regard the campaign as by any means over, and I have not the smallest doubt that when Professor Gregory comes to reply you will find that neither does he!

I would like to thank the Director of the Geological Survey for telling me a new fact, and that is that Professor Gregory is an Englishman. He is Professor of Geology at Glasgow, and I had always assumed that it would be very dangerous for an Englishman to profess the geology of Scotland in Glasgow! Further than that, I always assumed that he was a MacGregor who had dropped the "Mac." Really there is an omen in this. I am old enough to remember that once before an Englishman attacked the hierarchy of the Geological Survey in Scotland, and he came out victorious in the end. It was Professor Lapworth of Birmingham who fought a classical battle against the whole array of the Geological Survey, a battle on the question of the structure of the Highlands, and he won—an Englishman. I commend the case to the Director of the Geological Survey!

Professor Gregory was good enough just now to refer to some writing of mine twenty-five years ago. Several times in the course of those twenty-five years Professor Gregory has given me the very greatest pleasure by writing to me and telling me that now this and now that theory of mine had been substantiated by his detailed work, and this evening he has given me another instance. May I express a general geographical idea? When I first had to do with geography we youngsters were very much occupied with the question whether geography was a science or not, and we were very much occupied with fighting out the boundaries between geography and geology. We have all long since learnt that boundaries shift. But we have had this evening an illustration of the difference between them. To my mind, geography is not so much a science as a philosophy, an art, and a literature. Let me tell you my meaning by a musical analogy.

There is the bass of geology; there is the tenor of meteorology; there is the alto of agricultural, botanical, and zoological studies; and there is the treble of social, economic, and strategical studies. Now geography is a harmony of all four. This evening we have had a Gregorian chant sung by basses of the choir on the geological note. But, ladies and gentlemen, those surmises of mine to which Professor Gregory has referred were geographical; they were just due to looking, to gazing at the map. I was set the task as a young man of writing a book on the geography of the British Isles. There was vastly less definite knowledge available then than to-day, and one had to take the map just as one might take a musical score and try to read and hear its harmonies. There are some people who seem to be born with the love of a map in them, and there are others who seem absolutely incapable of getting any pleasure out of a map whatever. There are those who are born with geographical music in them, and there are those who will never, never attain to it. To my mind that is something which we, members of a geographical society, ought to remember in these days when the more daring stories of adventure are approaching their end. We have something which will last and last through all time: the innate and trained power of winning music from a landscape and from a map, and a music of full chords; not merely a tune sung by any one of the four voices.

I have ventured to refer to this matter to-night because Professor Gregory

brought to my mind that old study of mine. I knew a little bit here and there, but in the main I put forward ideas, due to gazing at the map by the hour together and trying to read its harmonies. It is a matter of the greatest delight that long years afterwards Professor Gregory, with all his authority, comes along and tells me that I was right in one or two of the ideas I launched. Well, there is more than pleasure, there is value in teaching this geographical music, because one of the roads to truth, in whatever sphere, is the road through harmony.

Dr. H. R. MILL: Professor Gregory always delights us, whether he is talking of the great Rift Valley of East Africa or of the little rift valleys of the west of Scotland. But on this occasion he has charmed me in a higher degree because he has rolled away at least forty years of my age and brought back the days of my youth when I sailed along those fiords month after month, summer and winter, carrying out investigations into their physical geography; and he has taken me back further, to the days of childhood amongst the goes and voes of that marvellous Caithness coast. We have heard of the magic charm of the West Highlands on many occasions; Professor Gregory has reminded us that that charm is deeper and older than Mary Rose, older than the Songs of the Hebrides, which have so often fascinated audiences in this hall; older and not less controverted than the Odes of Ossian; older, he dares to claim, than the Glacial Period itself.

I had stored up some smooth stones from the brooks of memory, but my old friend, Sir John Flett, has anticipated my bombardment with more authority and surer aim, and I bear him no grudge although he has eroded away the substance of the speech I might have made.

There are, however, still a few points which I should like to touch upon by way of criticism of Professor Gregory's paper, but they are points of a geographical rather than a geological nature. One is that I cannot wholly agree that the floors of the fiords in the west of Scotland are typically flat and trough-shaped. Most of those I have investigated are rather V-shaped in cross-section. The successive basins sometimes shown by a longitudinal section, separated from each other and from the sea by successive thresholds, have through their influence on tidal circulation a marked effect on changes of temperature of the water within them and on the life of the marine animals. These are matters the interest of which has been referred to several times before this Society and the facts in great detail are entombed, or perhaps entombed in the Transactions of other learned societies. I may refer those interested to the classification of the fiords and the lochs of the Clyde Sea Area which I made many years ago, and to the observations on that great shallow on the west of Scotland known in old days as the Vidal Bank, which is now recognized under the name of the Continental Shelf as part of one of the great features of terrestrial relief.

Professor J. W. GREGORY: It is impossible at this late hour to discuss all the points raised by various speakers and especially by Sir John Flett. I would only say that when I bear in mind the long controversy there has been between Glasgow and Edinburgh on this question of glacial erosion I am delighted to hear Sir John Flett admit so much.

I did not refer to the older fractures because it seems to me there is one simple test, provided by the dykes, which shows that all those older movements have had no direct effect upon the present fiords and lake basins in Scotland. Sir John Flett claimed that there can be no fiords without glaciers. One of the finest fiords in Europe is that at Cattaro, on the coast of the Adriatic, and

glacial action could have had no influence upon its formation. I quite agree that there has been some movement of the ice along the lower parts of the fiord valleys, even where the main movement of the ice was in a different direction. That shows that the valleys were there before the ice came into them, and therefore the glaciers cannot have made them. That the glaciers have had a certain effect by moulding and enlarging the valleys, I fully admit, but I am quite convinced that the main valleys were pre-glacial and therefore were not due to glacial action.

According to Sir John Flett, the ice-action was greater on the western side of Scotland. I personally think it was at least as great on the eastern side, because the greatest area in Scotland, above the height of 4000 feet, is on the eastern side. Though the Central Grampians have now a smaller rainfall, in the older times they would have had as great a snowfall as the western mountains. The abundant evidence of glacial action on the eastern side is accompanied by no fiords and no deep rock basins because the ice was acting upon an area which had not been ruptured by those great earth-movements which affected the west. I again thank Sir John Flett and you all.

The PRESIDENT: I am no geologist, but I am a man of a certain amount of circumspection, and I am certainly not going to put myself between Sir John Flett and Professor Gregory, who not only hurl about chunks of old red sandstone but apparently great blocks of millions of years! I beg to thank Professor Gregory and also Sir John Flett for having given us this very good discussion and having taught us such diverse things. It has been an excellent evening's entertainment, and I am sure you will express your appreciation to Professor Gregory for having initiated it.

SHIPS OF EARLY EXPLORERS

G. S. Laird Clowes

Read at the Afternoon Meeting of the Society, 17 January 1927.

IN dealing with the subject "Ships of Early Explorers," I must start by emphasizing two points: the first, common to the history of all early shipping, is what the geologists would call the imperfection of the record; the second is that explorers, from the Middle Ages at any rate right up to the present time, have normally employed small ships, and it is about the smaller craft of any period that detailed information is always least available. As to the imperfection of the record, it will be readily understood that to preserve through the ages the wood of which ships are built requires a combination of so many unusual circumstances as to make each preservation a veritable miracle. We have, in fact, one or two small Egyptian processional boats, two Roman vessels at the bottom of Lake Nemi—but not yet raised—a portion of a lighter of about 270 A.D. found in the Thames, a Frisian ship, two Viking ships; and these few examples, less than a dozen in all, can alone provide us with information as to the smaller details of shipbuilding over a period of about 3000 years.

In the British Isles, beyond the portion of a Roman lighter just mentioned and a number of dug-outs, whose age may perhaps be in no way commensurable with their primitive forms, we have a small royal barge of the reign of William and Mary, a large one of 1732, Nelson's *Victory* of 1765, with his funeral barge, and the *Implacable* of 1800; or, to put it more plainly, as far as the preservation of actual ships is concerned, from the time of the Romans until the seventeenth century the record is blank, and from the eighteenth century only two examples of big ships have been preserved for us.

There is also much imperfection in the pictorial representation of ships owing to the fact that they have at all times been most commonly represented broadside-on. Consequently it is extremely difficult to obtain any satisfactory idea of the real shape of early craft, and the more ancient models do not as a rule take us much further, for besides seldom giving much idea of the method of construction, they, in common with many representations in the flat, have frequently been greatly distorted in order to serve some particular purpose, either decorative or utilitarian.

With regard to the second point—the small size of the ships used by explorers—although from the sixteenth century, at any rate, we are all acquainted with the general appearance of the great “King's Ships” of England, the *Harry Grace à Dieu* and the *Sovereign of the Seas*, and, from 1660 onwards, the habit of making dockyard models has enabled many of us to know with considerable accuracy the details of the more important Royal ships, yet how many of us have any real idea of the appearance of the small traders of similar dates? And it was these small traders, in nearly every case, which carried the great explorers on their voyages to the ends of the Earth.

Of the more ancient civilizations, it is from Egypt alone that any detailed representations of ships remain to us, and I would therefore make a start from the expedition which the great Egyptian Queen Hatshepsut sent out to the land of Punt about 1600 B.C. The frescoes of her ships on her temple of Deir el Bahari are too well known to detain us long, but are so important as early detailed representations of sea-going ships that they repay considerable study. The construction, as may be seen from the model on the table, copied from a small funerary boat of rather earlier date in the Cairo Museum, is a skin of planks set edge to edge and connected together by a series of wooden ties, in the shape of double wedges, but built without stem, stern-post, keel, or any internal framing. A number of deck-beams stretch across the upper part of the vessel, but all necessary strength had to be supplied from the thin wooden skin. As a result, when it was desired to build large sea-going vessels for the voyage to Punt, now generally accepted as some part of the Somali coast, it became necessary—as had been done in much earlier Egyptian sea-going vessels—to add the trusses, which the fresco shows as stretching

from bow to stern of the vessel, supported by queen-posts along the central line.

I may mention that this same system of "hogging" trusses and queen-posts was developed in America some twenty-four centuries later and is now again to be seen in Egypt, in the more typical forms of modern Nile steambot.

Queen Hatshepsut's vessels were propelled alternatively by oars or by a large square sail, which served however only when the wind was very favourable. A point which must not be forgotten in interpreting all pictures of Egyptian ships is that their beam was fully one quarter of their extreme length, so that vessels which appear so long and slender in the frescoes were really in form very much like the bowl of a modern spoon. Further, like most primitive artists, and in fact most artists up to the seventeenth century, the Egyptians habitually showed the water-line very much lower than it can possibly have been in actual fact.

Curiously enough, the vessels of the explorers of Greece and even of Rome present in many ways a more difficult problem than do those of the Egyptians. No Greek ships of any sort have been preserved, and we are thrown back on a number of carvings, in apparently correct proportion, representing disjointed parts of galleys, and some paintings in which strict proportion has not been maintained.

I have collected here photographs of the bow of a galley which serves as a support for "Victory of Samothrace" in the Louvre, the side of a trieres from a sculpture in Athens and the stern of a galley carved on a rock at Rhodes.

Assembled, they form a fairly concordant whole, but there remain many difficult points which they do not clear up. A very important question, structurally, is whether they were built with a keel—all we can say at present is that no indication of a keel can be found—yet it is hard to see how a vessel such as the Athenian trieres, whose normal length was nearly 150 feet, can have had reasonably longitudinal rigidity without either a keel or a "hogging" truss. There is also the more attractive question as to how the rowers were arranged in trieres and higher rates, but as the main reason for the multiplication of rowers was to obtain increased speed, we may safely assume that such vessels were not used for exploration voyages, and I would therefore only call attention to the solution recently put forward by Mr. Vihelm Marstrand, which appears to me the most practical yet advanced.

To turn now to a reproduction, from a cup at the British Museum, of a Greek galley and merchantman of about 500 B.C.; the picture is instructive as showing the differences which had already developed between the fighting ships and the cargo-carriers, but as at that time all discoveries were strictly coast-wise and the early adventurers drew in to the shore nightly, galleys were the vessels employed. As long as the single square sail persisted the help of oars was most necessary, in order to combat

adverse winds, while the food and drink of the numerous rowers presented no insurmountable obstacle.

In Roman days the sails of the merchantman; as will be seen from a well-known carving from Ostia, had developed much further, and the additional sail on the "artemon," or bowsprit, must have greatly increased the power of manœuvre. Despite these improvements in sails, however, Roman exploration was carried out in the main by galleys, of which a fresco at Pompeii gives what is probably the best existing representation. It shows two long low vessels extraordinarily similar to the galleys which formed a great part of the Mediterranean navies right down to the end of the eighteenth century. Contrasted with a French galley of about 1700, these Roman galleys differ mainly in the form of the bow and in sails. The Romans had what would now be called a ram-bow, with the beak on the water-line, while the latter-day Mediterraneans employed an exaggerated clipper-bow, with the beak above water. One galley in the fresco has a primitive square sail, which could only have been used with a fair wind, hoisted on a very raking mast and obviously arranged for easy lowering when the vessel went into action.

If we now turn to the northern races we find that the art of ship-building, or perhaps it would be fairer to say the art of seamanship, had so far advanced that after discovering Iceland in the ninth century, the Vikings were able to make voyages thence to Greenland and even on to the American mainland. Fortunately there still exist in the Museum at Oslo two actual Viking ships which have been preserved almost intact from the ninth century. The Gokstad ship, the more interesting of the two from the point of view of discovery, represents just such a ship as that in which Eric the Red voyaged to Iceland about 1000 A.D., or in which his son Lief Ericson reached the shores of Vineland some years later. The ship was found in 1880, buried in a tumulus in Norway, and save for the higher portions of stem and stern-post very nearly complete. She is an open double-ended boat, built to most graceful lines with a deep rockered keel and considerable sheer. The length is 79 feet, breadth 16.5 feet and she pulled thirty-two oars and must have carried a crew of about seventy men. She was built as much to sail as to row, for each of the oar-ports could be closed by means of a small pivoted cover. Although she has few of the characteristics which we should now regard as suitable for stormy seas, boats of a very similar type were still employed on the northern coast of Norway, and smaller boats, on lines identical with the ancient ships, may still be seen in use in the Shetland Islands.

The Viking ships employed one large square sail set on a stout mast which was stepped amidships, and there is some evidence to suggest that they were able, by bracing the yard well forward, to sail with the wind on the beam, or even forward of the beam. A temporary hut with a

ridged roof could be erected amidships for the accommodation of the chief, and it is probable that at night, and especially when in harbour, an awning could be spread over nearly the whole length of the ship.

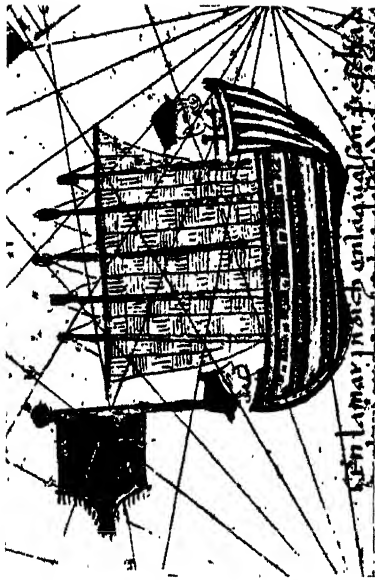
All indications go to prove that very similar ships were employed in the invasions of Britain by the Angles, the Saxons, and the Danes, and though a distinction is drawn by contemporary writers between the ships of King Alfred and those of his Danish enemies, it is hardly probable that it was much greater than that between the uniform and equipment of British and German soldiers of the Great War, a distinction obvious and important in the mind of a present-day historian, but entirely negligible if viewed from the standpoint of a thousand years hence.

After the lives of the Norsemen became more settled, there is little indication of any improvement in naval architecture; in fact, what change there was seems to have been in the direction of broader and clumsier vessels. The ships depicted on the Bayeux tapestry differ little, save in diminished length, from those of the Vikings, and during the twelfth and thirteenth centuries, except in the Mediterranean, oars were largely discarded and a type of short broad cargo vessels became general on the Atlantic seaboard. These ships still had only one sail, and until well into the thirteenth century they retained the pointed stern, with a steering-paddle pivoted on the quarter, of the Viking vessels. There was need however for increased passenger accommodation, and soon after the introduction of the centre-line rudder, hung from the stern-post, the sterns became very much fuller so as to support a large summer-castle or after-castle. Concurrently a fore-castle was fitted in the bows to provide a commanding position for the fighting men.

Neither the ships nor the conditions of Europe during these disturbed centuries gave much impetus to exploration, and that maritime traffic of which we hear most from historians concerned itself with the transport of Crusading armies and their supplies through the length of the Mediterranean.

After this long period of little or no exploration comes the interesting time of Marco Polo's travels, between 1271 and 1295, when, owing to the conquests of the Mongols which broke down the religious seclusion of the Muhammadan races, the East was laid open for a time to European exploration.

In the Mediterranean, galleys propelled by oars were then the most common means of transport, but as by that period they were manned entirely by slaves, they were no longer suitable vessels for long voyages of exploration. With the ancient races, the Athenians at any rate, the galley crews were free-men and so could be trusted for long and arduous voyages, but no man in his senses would risk delivering himself, in unknown seas, into the hands of men whom the first accident would raise against him. As therefore galleys were then unsuited for explora-



*Chinese Junk in the Red Sea
From the Catalan Map, 1375, Bibl. Nationale, Paris*



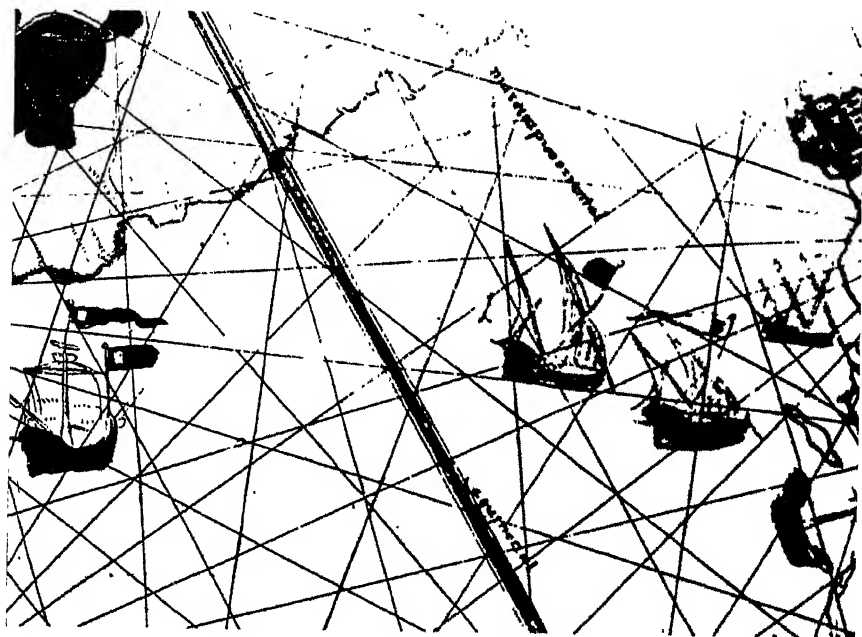
Ships round the British Isles



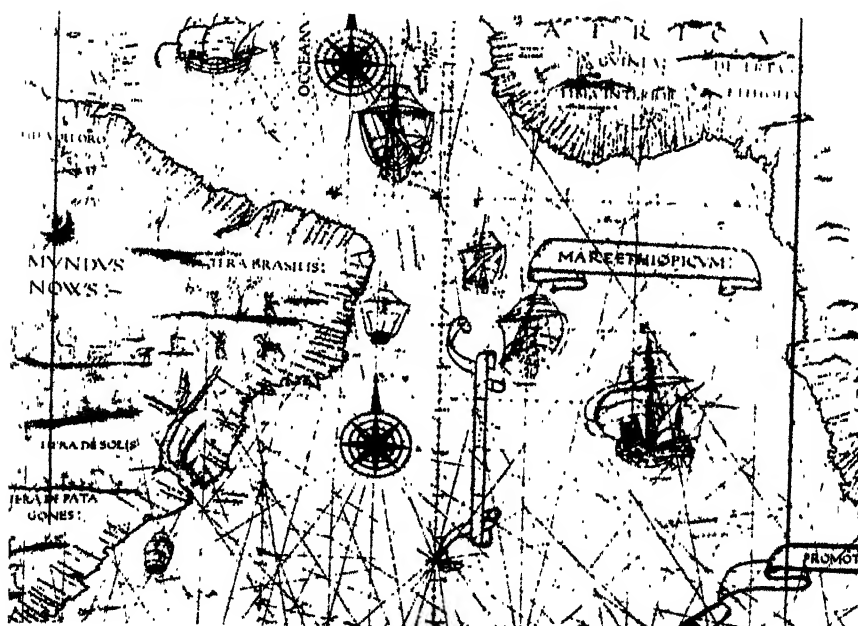
Chinese Junk (Fra Mauro)



*Ships off Arabia
From the Map of Fra Mauro, 1457, in the Bibl. Marciana, Venice*



Ships in the Indian Ocean
From the map of Juan de La Cosa, 1500 Madrid



Ships in the South Atlantic
From the Map of Diego Ribero, 1529. Collegio di Propaganda Fide, Rome

tion, the interesting arrangement of the oars in these biremes, and in the triremes which succeeded them, need not detain us.

After the introduction of the triangular lateen sail into the Mediterranean, in the wake of the Arab conquerors—for the first known representation of a lateen sail dates from about 886 A.D.—some of these craft were rigged with two masts, and in 1191 we are told that Richard Cœur de Lion encountered and defeated a Saracen vessel with three masts; but the use of more than one mast did not at this period spread outside the Mediterranean nor did it extend to square-rigged craft. And indeed, inside the Mediterranean, the fashion of two-masted lateeners seems by the fourteenth century to have almost died out.

Only a comparatively small part of Marco Polo's travels were by ship, but he described the ships of Ormuz, in the Persian Gulf, and in very great detail the Chinese ships of the China and Indian seas.

The ships of Ormuz were undecked vessels, made without nails but sewn together with coir rope; they had one mast, and Polo notes that they had only one rudder, that is a rudder on the stern-post instead of two quarter-rudders, as was then common in the Mediterranean. This description would still fit almost exactly a number of present-day vessels from the Arabian Sea, and, save for the modern introduction of a small second mast and a line of dummy ports, may be illustrated by a model which only dates from about 1830.

Marco Polo emphasizes the comparative unseaworthiness of these vessels and contrasts them with the great size and strength of the Chinese junks, thus unintentionally explaining why the sea-borne trade, even as far west as the Persian Gulf, was in the hands of the Chinese.

In his well-known description of Chinese junks he mentions their great size, with as many as fifty or sixty cabins, their internal subdivision into water-tight compartments, and the fact that they were rigged with four permanent masts and two others which were sometimes stepped. He describes in fact, except for their diminished size, the Chinese junks of to-day, or at most a few years ago, with their four masts—fore, main, and two mizen, stepped side by side on the poop—and with a fore and a main topmast for use when winds were light.

Such descriptions have left their mark on the maps of succeeding centuries, for the Catalan Atlas, prepared by the order of Charles V. of France in 1375, shows in the Indian Ocean curious vessels with mat sails and a number of masts. The draughtsman however has made them a little difficult to recognize by coalescing all the sails into one large square sail, in order to make the vessels correspond with the ship with but a single square sail with which he was familiar in Europe. The row of square portholes should also be noted, for although a decoration of square dummy ports is typical of Chinese junks of a later period, and may in fact represent a survival of the windows of the many cabins referred to by Polo, yet no portholes were cut in the sides of any

European ships until they were required to accommodate cannon, at the beginning of the sixteenth century, more than one hundred years later.

Even more interesting are the vessels shown in Fra Mauro's Map of 1457, which is generally considered to be largely based on Marco Polo's travels. If we follow the coasts, travelling from Northern Europe, we find in Fra Mauro's Map first a number of one-masted vessels with a single square sail and with marked fore and after-castles, essentially similar to the reconstructed model of the thirteenth century shown on the table, except that by that time they had stern rudders. In the Mediterranean are a number of galleys and lateen-rigged vessels without fore-castles, and none of them with more than one mast. In the Gulf of Guinea, the uttermost point of sea exploration of that period, is shown a two-masted vessel of rather uncertain type, but as soon as we have rounded what is now known as the Cape of Good Hope we fall in with a number of extraordinary lofty vessels with three or four masts and high after-castles. Both bow and stern are very square and highly decorated, and the rudder is shown as projecting below the stern, in a curiously detached position. I am unaware that any explanation of these craft has previously been attempted, but to my mind they represent with surprising accuracy the Chinese junks which Marco Polo describes as carrying the bulk of the trade of the Indian Seas.

If we compare them with the modern Chinese junk, the draughtsman's only error lies in his inability to understand the Chinese fore-and-aft sails, for he has represented in each junk a square sail of the type known to him in Europe, although where the yards are shown lowered their position is the same as in the modern Chinese vessels. Interspersed among the junks are a number of one-masted lateen-rigged vessels which only differ from those of the Mediterranean in their longer projecting sterns—and this is a characteristic which could be found in some Arab vessels right up to the middle of the nineteenth century.

I would direct particular attention to the multiple masts of the Chinese junks because, as shown on Fra Mauro's map, the vessels of Europe were then essentially one-masted, and although some two-masted ships had existed and probably still existed in the Mediterranean, European vessels of three masts were then not known, nor have we any record of them until 1466, nine years later than Fra Mauro's map. It was the introduction of the three-masted ship, with its improved ability to contend with adverse winds, which made possible the great voyages of discovery of the end of the fifteenth century, of Columbus to the West Indies, of Vasco da Gama to India, and of the Cabots to Newfoundland, and it is a curious thought that this great development may really have been due to the introduction into Europe of accounts of the multiple-masted Chinese junks which traded so effectively in the Indian Ocean. Far-fetched as this idea may seem to my audience, it is a fact that no one has yet been able to

explain satisfactorily the cause of the extraordinary and rapid development—in the course of only fifty years—of the one-masted vessel of 1450, able only to run before the wind, into the three or four-masted sailing ship of 1500, similar in all essential principles of rig to the three-masted ship of the seventeenth century.

To come now to the great age of discovery which opened with the voyages along the African coast made under the orders of Prince Henry the Navigator. These voyages started in 1418, and before the Prince's death in 1460 his captains had reached the mouth of the Gambia. Advance however was slow, and I think that ample reason may be found if we turn back to the contemporary map of Fra Mauro of 1457 and note that all the ships shown on the Atlantic seaboard were one-masters, and most of them fitted with the square sail which precluded progress against the wind.

As I have already said, the first known example of a three-masted ship dates only from 1466, but before the end of the century, with this advance to aid them, Christopher Columbus reached the West Indies, and Vasco da Gama, instead of stopping short like his predecessor, Bartholomeu Diaz, at the Cape of Good Hope, was able to round it and sail right on to India. Nothing is known as to the details of Diaz's ships, but from the date they may well have included, besides lateen-rigged carvels, square-rigged three-masters of a very primitive type, probably without any topsails and very similar to some of the Mediterranean craft illustrated in the later pages of the contemporary manuscript of the Pageant of the Earl of Warwick. By the time of Vasco da Gama however further development had taken place, and two of his vessels, the *S. Gabriel* and *S. Raphael*, of which a drawing made within fifty years of his return may be taken as a reasonable representation, were "naos," square-rigged with topsails on the main and foremasts and a spritsail under the bowsprit. The *Berio* or *S. Miguel* was a lateen-rigged carvel, while the store-ship was probably partially square-rigged like a "caravela redonda." Da Gama's flagship was of nearly 200 tons burden and perhaps 85 feet long. Columbus's ships must have been very similar, but, curiously enough, despite the very numerous reconstructions of the famous *Santa Maria*, there is no reasonably contemporary reproduction of her or of any of her consorts. We know however that she was a "nao," square rigged, with a topsail on her mainmast only, that is, her sails were slightly more primitive than the drawing of da Gama's ships. Of his two carvels, Columbus converted the *Pinto* from fore-and-aft to square-rig for the purposes of the voyage.

Juan de la Cosa's map of 1500 contains excellent illustrations of vessels of this period. In the Indian Ocean we find a number of Portuguese vessels, carvels fore-and-aft rigged with two or three triangular lateen sails, and also one square-rigged "nao." We further find a curious

square-ended vessel with a high bow and stern which again suggests a Chinese junk ; but in this case, although the shape of the sail is fairly correct she has, unfortunately, only one mast.

On the American coast two Spanish square-rigged ships are depicted, but the artist, apparently more accustomed to carvels, rather slurs the distinction between square and fore-and-aft sails. I might mention that in the well-known picture of the departure of King Henry VIII. from Dover in 1520, to attend the Field of the Cloth of Gold, the same confusion occurs.

To come now to Magellan and his voyage through the Straits of Magellan and round the world, between 1519 and 1521 ; I fear that I must cast down an idol, for the representation of one of his ships, the *Victoria* of 85 tons, which forms the badge of the Hakluyt Society, is so well known to us. The drawing occurs in a map of the Pacific by Ortelius, dated 1589, but unfortunately one can only say of it, as one must say of the ships in quite a number of old maps, notably Martin Behaim's globe of 1492 and Mercator's Maps of 1554-1569, that such ships never were. The two-masted *Victoria* is really a terrible ship, partially mediæval, partially Roman, and totally impossible.

To take it out of your minds, I will pass on to the beautifully drawn ships contained in Diego Ribero's map of 1529, only eight years after the completion of Magellan's voyage. These are ships returning from the Moluccas, and show in perfect detail the condition of the arts of ship-building and of rigging at this period. Essentially they are three-masters similar to the larger ships of Vasco da Gama, but many interesting details are brought out, the wales and skids, or strengthening pieces along the sides of the ship, the square tuck at the stern, and the high forecastle with one large arch under it, as in ships at the end of the previous century. The sails show the very small and comparatively insignificant topsails on the mainmast and foremast, the great size of the main-course, which still remained the chief driving sail of the ship, compared with the small fore-course only about seventy years old and still rudimentary, and particularly the two "bonnets," or more correctly the bonnet and drabler, fair-weather additions laced on below the main-course, in such a way that if the wind freshened, they could be instantly stripped. Holbein's picture of about 1532 is also of considerable interest as showing a near view of a very small vessel, only about 40 feet long and 15 tons burden, but rigged, as were practically all ocean-going vessels then and for long after, with three masts and square sails on the fore and main masts.

Turning now to the famous explorers of the end of the sixteenth century Frobisher, Drake, and the Dutchman Barents, once again the information available is of the slightest. Martin Frobisher's two ships, the *Gabriel* of 20 tons and the *Michael* of 25 tons, were so small as to be no larger than fishing-boats. Drake's *Pelican*, which in the course

of his voyage of circumnavigation he renamed the *Golden Hind*, was larger, with a burden of 150 tons; but even that will not allow for the high quarter-deck and poop and the four guns aside on a lower gun deck which are shown in the picture of the *Golden Hind* which decorates the border of Hondius's map of Drake's voyage. This map was published about 1595, fifteen years after his return, and is therefore a document on which our inclination is to rely as contemporary. The companion picture of the ship aground near the Celebes may give a slightly truer impression of her size, particularly if we take into consideration the floating cask near her, but I fear that even there the artist's enthusiasm has run away with him. She must really have been very much more like the small and much less lofty ship, about 73 feet long and of 145 tons burden, shown in one of the shipwright's drawings in 'Fragments of Ancient Shipwrightery,' a most important manuscript of a few years later, which is still preserved in the Pepysian Library at Cambridge.

When we remember that after Drake's return the *Golden Hind* was placed in a dock at Deptford and the dock was filled in with earth—very much as Nelson's *Victory* has recently found a permanent home in a dock at Portsmouth—and that for nearly one hundred years she formed one of the sights of London, it is indeed curious that no detailed representation of the first English ship to circumnavigate the world is left to us.

It is the smallness of the ships of the great explorers which defeated the artists, for to their minds their size ill befitted the great deeds that were done in them.

For Barents' vessels we are on safer ground, for the illustrations in de Veer's account of the adventures of the party in Novaya Zemlya, published the next year, give an excellent idea both of their ship and of the boats which they built after they had been compelled to leave their ship, and in which, after the death of Barents, they made the long voyage back from Novaya Zemlya to Amsterdam.

Ships, and even the small ships of explorers, were now beginning to approximate much more closely to the sailing ships of the late eighteenth century, with whose appearance we are all reasonably familiar. The *Sea-Hen*, in which, in 1642, Tasman discovered both Van Diemen's Land and New Zealand, cannot have differed much in appearance from the Dutch *Flute* which is depicted in an engraving of that period by Zeeman. The masts had by then become considerably longer, and the topsails were both longer and wider in the head, and in fact played a much more important part in propelling the ship than they did in the sixteenth century.

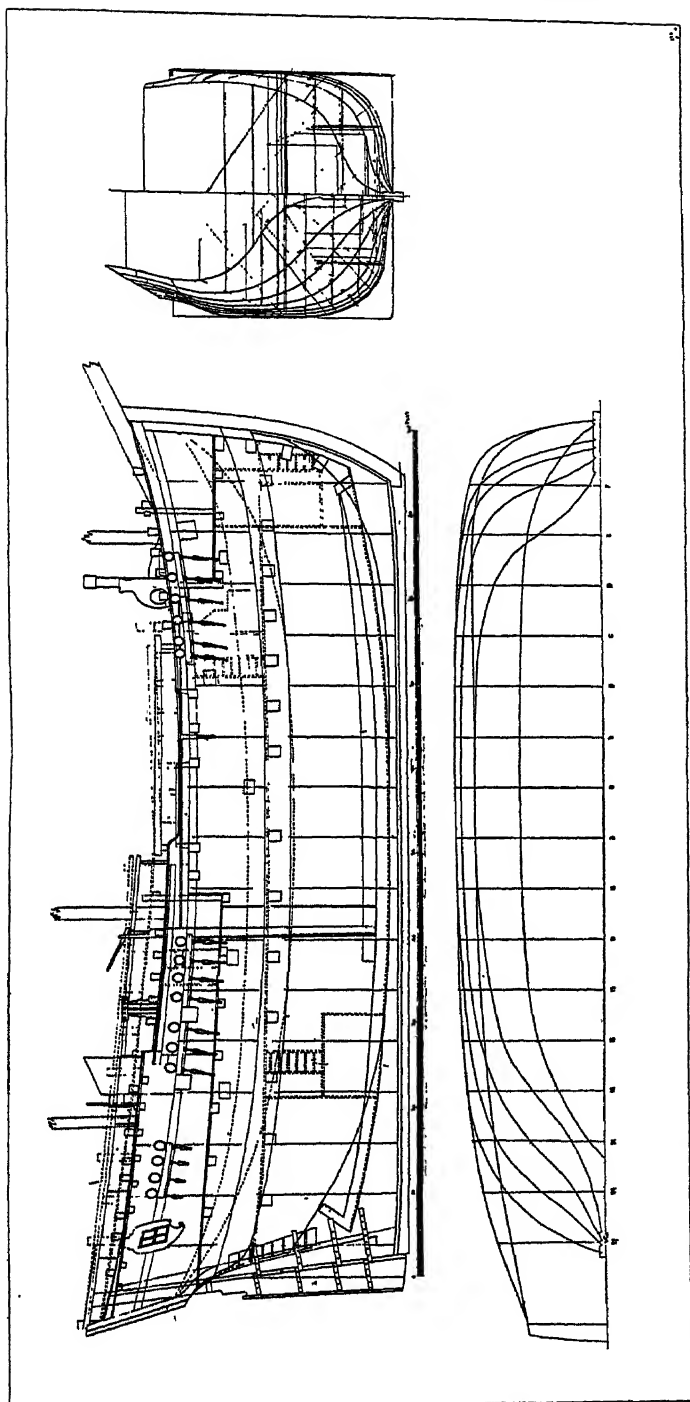
The *Cygnets*, in which Dampier made his voyage to Australia in 1688, and the *Roebuck*, in which he reached New Guinea in 1700 and which ultimately sank off the Island of Ascension, were both small merchantmen, bought for the occasion, and neither of them to be found in con-

temporary lists of the ships of the Royal Navy. A drawing of the *Mary Galley* of about 150 tons, which made the voyage to India in 1605, and from whose building specification and other papers it has been possible to make a fairly detailed reconstruction, gives a good idea of the type of vessel which he must have used, and this may be matched by an engraving of 1715, which shows a small merchant vessel off the London Custom House. It should be noted that while a square topsail on the mizen mast had been in regular use in the Navy for nearly a century, it was not yet employed in small merchantmen, nor had they ever taken to the spritsail topmast at the bowsprit-end, so typical of seventeenth-century men-of-war.

After the middle of the seventeenth century, however, we for the first time reach really firm ground, for we are able to find authentic, contemporary, and detailed representations of some of the ships of Captain James Cook.

His upbringing had been all in the coal trade, between the north-country ports and London, so it is not to be wondered at that, when in 1768 he was commissioned to prepare a ship for his first voyage, to observe the 'Transit of Venus, he turned to his home port of Whitby and selected the "cat-built" bark *Earl of Pembroke* of 366 tons, built at that port nearly four years before.

The collier barks of this period, the forerunners of the collier brigs of the nineteenth century, were stoutly built vessels, full in the body and bluff in the bows—excellent sea-boats and with plenty of space for the stowage of stores for Cook's long voyage, and with some room at any rate for the two scientists and other supernumeraries who accompanied him. We are fortunate—I may say most unexpectedly fortunate—in possessing the draught of the *Endeavour Bark*, as she was renamed, with a suffix to distinguish her from the existing King's ship *Endeavour*, which must have been made when she was taken over by the Admiralty. The draught, which is in possession of the Australian Pioneer Club, shows in dotted lines the alterations and additions made in order to suit her to her new service. The rails in the stern were raised and prolonged, a complete orlop deck was fitted on the existing beams, and also an athwartship forward bulkhead; four companion ladders were added in order to make the orlop and the hold more accessible, and a new galley—to provide cooking facilities for the increased crew—was fitted on the orlop deck. Collier barks were not then provided with figure-heads, and the absence of this very typical mark of a King's ship may very probably have been the cause of the inconsiderate treatment to which Cook was subjected at Rio de Janeiro on his outward voyage, where the Viceroy was unwilling to believe that the *Endeavour* was really a King's ship, and insisted on maintaining a guard over her all the time she lay in harbour. Small colliers of this period had still not adopted a square topsail on the mizen, but this sail seems to have been added, making the sail-plan of the



The draught of H.M. Bark "Endeavour," redrawn from a photograph of the original in the Pioneer Club, Sydney

Endeavour exactly similar, save for the absence of royal sails, to that usual in small sloops-of-war. It can be realized from the plan that the accommodation afforded by this 100-foot vessel for the ten or more persons who berthed aft was of the scantiest description—the total cabin space was only about 45 feet long, with a height of 5 feet forward and 6 feet aft; but, on the other hand, we must not forget that the *Endeavour*, compared with the vessels of previous discoverers, was a large ship, for she was more than twice the size of Drake's *Golden Hind*.

For his second voyage of 1772-1776, Cook again had resource to Whitby colliers, although one of these he selected, named by the Admiralty *Resolution*, was 100 tons larger than his previous ship. An admirable contemporary painting of Cook's departure from the Thames on this expedition has recently come to light, and in consequence we again know considerably more of these ships than of those of any previous explorers. As a result apparently of the Rio de Janeiro incident, figure-heads were fitted to both ships—a sea-horse for the *Resolution* and some sort of nymph for the *Adventure*, but otherwise, except for the addition of rails and for the rigging, which was brought into line with man-of-war fashions, the *Adventure* seems to have remained almost unaltered. Cook's own ship, the *Resolution*, was fitted with a "coach" or "round house" aft, for the use of the commander, and her upper works were also raised by a foot. An attempt had been made to close in her waist with a spar deck, but she proved so crank that, in addition to reducing her lower masts by 2 feet, this deck had ultimately to be removed, with the result that Mr. Banks (afterwards Sir Joseph), wiser from his previous voyage, refused to put up again with such limited accommodation, and declined to sail with the vessel. He had previously tried to arrange for the employment of an East Indiaman or a 40-gun ship in place of the *Resolution*, but Cook strongly objected to any other type of ship being used.

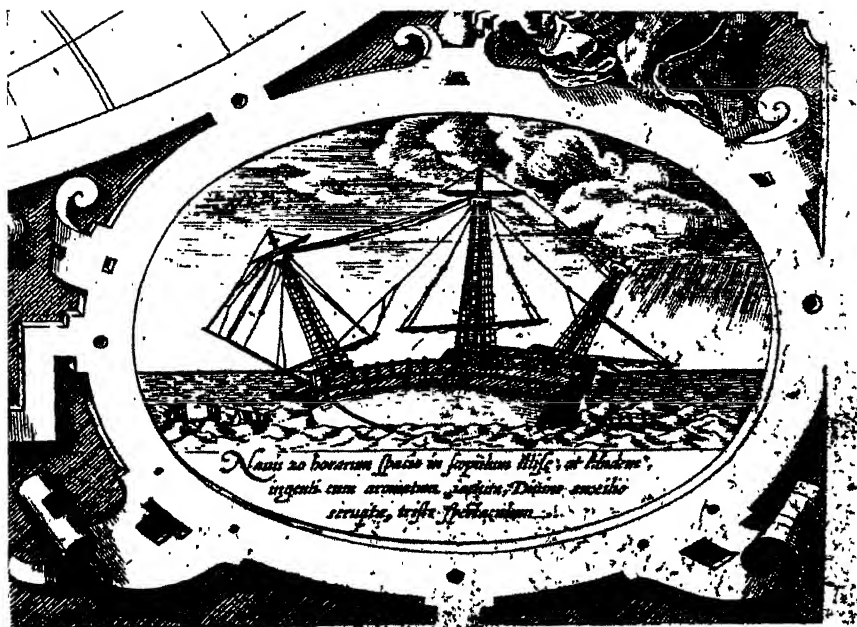
I may perhaps be allowed to add that, desirable as it is that this very historic picture of the *Resolution* and *Adventure* should be preserved in this country, the probabilities seem to be that it will leave us before long for Australia.

On his third and last voyage Cook again sailed in the *Resolution*, but the *Adventure* was replaced by the *Discovery*, another Whitby collier purchased specially for this work, but rather smaller than any of his previous ships. This vessel was again used by Vancouver in his voyage of exploration along the north-west coast of America. A contemporary print shows her as she lay aground for some ten hours in Queen Charlotte Sound in 1792. The little *Chatham Tender* of 131 tons, which accompanied her, was one of a class of four brig-rigged tenders built in the year 1788.

Considering the doubts and uncertainties of the earlier part of this paper, I am glad to have been able, before closing it, to point at last



The "Golden Hind"



The "Golden Hind" aground near the Celebes

From the map of Hondius: 'Vera Totius Expeditionis Nauticae Descriptio D. Franc. Drac.' [Amsterdam? c. 1595?]



Resolution *Yacht* *Resolution* *Scorpion* *Adventure*
Cook's Ships, H.M.S. Resolution and Adventure, in the Downs before sailing on his second voyage, 1772
From the painting by Francis M. Cook

to one explorer, the great James Cook, about whose ships, despite numerous and popular misrepresentations, we have sufficient detail to make an accurate reconstruction possible.

In conclusion, I must express my thanks to Mr. Hinks, our Secretary, and to Mr. Heawood, our Librarian, for the great help and encouragement which they have given to me in the preparation of this paper, and particularly in obtaining photographs from some of the many interesting maps in the Society's Library; and also to my Chief, Colonel Sir Henry Lyons, who has allowed me to make such full use both of models and of lantern slides from other models and drawings which form part of the Ship-Model Collections at the Science Museum. The nautical collections there are rather heavily camouflaged under the title "Water Transport," and it is unfortunate that, although larger and of wider scope than any other in the Empire, they are so little known. The completion of the new galleries in Exhibition Road and the transference there, and consequent rearrangement, of the ship-models will, I hope, make the collections more familiar to that great section of the British people in which a love for things maritime is innate.

ADDITIONAL NOTE ON COOK'S SHIPS, THE "RESOLUTION" AND "ADVENTURE"

By the kindness of Mr. Francis Edwards, the owner of the picture briefly referred to above, it has been placed on view in the Museum of the Society, and Mr. Laird Clowes has written the following note upon it, which should be read in comment on the reproduction opposite. A permanent photograph of the painting will be hung in the Smoking Room at Lowther Lodge.

This most interesting contemporary picture shows Cook's two ships in the Downs in 1772, at the start of his second voyage of discovery. It was painted by Francis Holman, an artist responsible for a good many of the portrait or "builder's" pictures of ships, so popular at that period, and in common with most of these pictures, it embodies in one group a broadside and a stern view of each ship shown. Many "builder's" pictures included a third view of the ship, bows on.

After a quiet country life of some 150 years, the picture was shown at the British Empire Exhibition at Wembley in 1924, but for some reason failed to attract any special attention, and it was not until it passed recently into the hands of Mr. Francis Edwards that its existence became known even to that small group of persons who are interested in the archæology of ships. To these it is of special importance, because in the place of the ordinary men-of-war of the period Cook employed for all three of his voyages Whitby-built collier barks specially purchased by the Admiralty and refitted for their destined purpose. Further, except for small and none too illuminating sketches, the only authentic draught of any of these ships previously known was that of the *Endeavour* bark, which is preserved at Sydney. The model of the *Resolution* at Whitby, reproductions of which have been published, and the drawing at the Royal Geographical Society, which have clearly both a common source, contain such obvious anachronisms and display so few of the known characteristics of the ship as to be worse than useless.

In the centre of the picture Cook's own ship, the *Resolution*, is shown,

broadside on and just about to drop her anchor. The main and mizen courses have been taken in and the crew are in the act of clewing up the fore course, while the main and fore topgallant yards have been lowered on to the caps, with their sails flying. Towards the stern, standing on the "coach" or "round-house" which was specially added at Deptford for his accommodation, is seen a figure which presumably represents Captain James Cook himself, with a telescope to his eye.

The rig of the *Resolution*, and also of the two other ships shown, is that typical of all small men-of-war of the period. The vessel has as figure-head a carved sea-horse, and she shows six guns in ports along her side. One or two of these guns, however, may well be due to artistic licence, as her main armament apparently consisted of twelve guns only.

On the right of the picture is a broadside view of the *Adventure* already at anchor and swung head to wind so that her partially furled sails have been taken aback. It can be seen that her refit was much less extensive than was that of the *Resolution*, and she retains in fact, except for her figure-head of a carved "Diana," her naval rig, and her six guns, all the characteristics of a collier. As a smaller ship of 336 tons, in contrast to the *Resolution's* 462 tons, she has a single window set flush in a "badge" on the quarter, in the place of the projecting quarter-gallery of the larger vessel, and her guns point over the rail instead of being placed in port-holes.

To the extreme left, both vessels are seen as they must have appeared a little later in the day, after they had got up their anchors and started on their voyage down channel, sailing on the starboard tack. Each ship carried her name painted under the stern windows, but while in the *Resolution* there are seven windows and projecting quarter-galleries, with the "coach" above, the *Adventure* has a much narrower stern with only four windows, the central panel being occupied by a carved female figure.

The small schooner-rigged yacht in the "foreground" is very typical of the period, and it should be possible, with some little heraldic research, to identify the brilliantly dressed figure of her owner, with his gold lace and red waistcoat, from the arms emblazoned on the blue flag at the stern—Argent, a bend sable, charged with three owls gardant, argent; crest, an owl gardant, argent.

Another three-masted ship, also shown in two positions, but in the far distance, bears on her stern the name "Scorpion." That she forms no part of Cook's expedition is shown by the fact that she is flying the blue ensign, while the explorer's two ships fly the red. If the name has been read aright, she must represent H.M. sloop-of-war *Scorpion*, of 16 guns, which was wrecked in North America in 1780, and which appears to be the same *Scorpion* as was built at Bewley in 1746. No explanation of the presence of this vessel in the Downs and of the reason for her inclusion in the picture has yet come to light.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: We are going to listen to Mr. Laird Clowes, who not only inherited a knowledge of ships but is the chief assistant of Sir Henry Lyons in the Marine Department of the Science Museum. He has therefore, for more than one reason, a unique knowledge of the construction and form of ships of the past. I believe that his original idea, when he proposed to speak to us this afternoon, was to concern himself mainly with the ships depicted on mediæval maps. I am not quite sure whether he desired to date the maps by the ships or the ships by the maps; but at any rate I understand that further research brought him to the con-

clusion that those ships are in many cases so conventionally represented or, at any rate, so much assimilated to ships which were known to the actual draughtsman of the map, that they were useless for either of his purposes, whichever had actually been his aim. Therefore he has changed his intention and is now going to give us an account of the ships in which the great explorations were done; the ships were astonishingly small, but the explorations, as you know, were fraught with the greatest results in their own time and for all time to come. I have no doubt that he will tell us a great deal which will add greatly to our knowledge, and also—which is more important—with very great authority.

Mr. Laird Clowes then read the paper printed above, and a discussion followed.

Sir HENRY LYONS (Director, Science Museum): I am afraid I can add very little to the real interest of the paper, because the subject is one of which I have no first-hand knowledge, but I should like to emphasize the point that Mr. Laird Clowes has made about the extremely scanty nature of the information. He has, as he told you, gleaned some from the old maps in the rooms of this Society; he has also endeavoured, I know, to find some further information in regard to the earlier Elizabethan ships in some West Country towns, but unsuccessfully. We should be very glad indeed to have the means of making one or two, even more, models of those earlier ships if only really reliable and technical information could be found anywhere. I am afraid the chance of finding any considerable amount of information is not very good, but it may exist somewhere, and if any one can help us to find earlier information we shall be grateful for the opportunity of using it.

Major EVAN FYERS (Member of Council of the Society for Nautical Research): We have listened, I am sure, with very great interest to Mr. Laird Clowes' lecture. He has really "surveyed mankind from China to Peru." I want to bring you back to Thebes, to that wonderful rock-cut temple of Queen Hatshepsut at Deir el Bahari with its wonderful paintings, including representations of ships, and one of which is said to show ships loading with all sorts of merchandise for that expedition to Punt, which I think has been ascribed by Maspero to somewhere in the neighbourhood of Cape Guardafui, a long way from Thebes. Those boats, whether they are there for merchandise for Punt, or whether they are intended, as was brought out by Admiral Ballard, for the transport of obelisks from Aswan down the river to Luxor, were very suitable for river navigation with its many shoals, shifting sands, and so on, but I cannot conceive of anything more unsuitable to take any goods round to Cape Guardafui or Somaliland. Perhaps the lecturer or some one else could tell me whether it has not been lately discovered that some of the earliest shipping, perhaps in the world, belonged to the Minoan Empire in Crete, and at any rate they preceded the nautical knowledge of the Phœnicians by several centuries. At the time when that expedition was projected Phœnicia was being conquered by the Egyptians, and it is a remarkable thing to remember that practically on and off for a thousand years Phœnicia was subjected to the Kings of Egypt, who thereby obtained the services of their deep-sea ships. Surely it would be much more reasonable to suppose that flat-bottomed ships, such as the one depicted at Deir el Bahari, would have navigated down the Nile, and the goods would have been transhipped to a sea-going ship and carried all the way round Africa. One can hardly imagine that they would have indulged in portage right across the Isthmus of Suez and then come all down the Red Sea. In 599 B.C. Ezekiel was carried off from his home in Jerusalem to Babylon, and

I would refer you to his description of the ships of Phœnicia of that time (Ezek. xxvii. 5), at the conclusion of which he gives details of the merchandise carried by the Phœnicians from all parts of the then known world.

As to the interesting slides that Mr. Laird Clowes has shown giving details, mostly from the ancient cartographers, of the ships of their time, I should like to mention the marvellous collection of Belgian and Flemish paintings now shown at Burlington House, in two or three of which are to be seen ships similar to those shown in the slides with which Mr. Laird Clowes illustrated the lecture.

Explorers did not always use merchantmen, particularly for Arctic exploration. When Captain Cook was away on his second expedition, which you will remember was to the Antarctic, we had another expedition going to the Arctic. In that expedition there were two ships, the *Race-horse* and the *Carcass*, which were selected because, being Bomb-vessels, their construction was more substantial than any others. Nelson served as a midshipman in the latter, whilst the commander of the expedition, Captain Phipps, was in the *Race-horse*. The *Race-horse* was 385 tons and the *Carcass* 309 tons, so that they were not very different in size from Captain Cook's ships.

Professor GEOFFREY CALLENDER: In his opening remarks Mr. Laird Clowes gave us a list of famous ships which were constructed more than a century ago, and which survive until to-day. I would like to add to his list one further name, that of the *Chadervua*, a vessel said to have been 270 years old when she was moved in 1912 to her present position in a shed by the Golden Horn. She belongs to the Galley type, and presents some interesting features.

In the course of his remarks Mr. Laird Clowes marvelled, as I do, that no vestige was ever left of Drake's *Golden Hind*, though orders were given that she was to be laid up and preserved. The *Victory* is not, however, I am glad to say, being embedded in a dock; the restoration is being carried out in such a way as to render it possible for visitors to observe the under-water form of the ship and subsequently explore right under her keel, passing all round her.

I think that the lecturer was very successful in compressing into a brief hour's discourse a general view of the ships which were employed by the early explorers. There are, however, just two points on which I should like to touch—two points where the thread which ran through his argument seemed, if I may say so, to function with some difficulty.

In the first place, the lecturer seemed to me unduly to insulate the ships of the Viking age. In doing so he was doubtless following the fashion of those who have gone before; but I think that the time has come to work out the connection between the vessels built by the Vikings and the vessels of the Mediterranean. The Viking vessels—detached from the main trend of civilization—appear like mystery ships, arising out of nothing to astonish the world, and then sinking once more into oblivion.

The lecturer gave us an excellent picture of a Roman merchantman from the tablet at Ostia, which showed a vessel of heavy build. Yet on the score of sea-worthiness the Romans were astonished by the vessels of Northern Europe. Julius Cæsar describes for us the ships of the Veneti, and tells us that their sails were made, not of sail-cloth, but the skins of beasts. His comment is notable. The Veneti, he says, were probably not unfamiliar with sail-cloth, but used skins in preference because of the violence of the weather in the northern seas. The Roman Empire fell in the fifth century, and it might be supposed that all chance of communicating with the North of Europe passed away. As a matter

of fact, Justinian revived the Eastern Empire in the sixth century, and in the seventh and eighth centuries there was frequent communication not only between the east and west, but between the east and the extreme north-west, between the Ægean and the North Sea. My own belief is that there was a distinct connection between the Byzantine vessels and that development of northern craft which eventuated in the ships of the Vikings. I am not suggesting the substitution of Byzantine vessels for those of the Veneti. The blending of two types, I believe, produced a compromise or, if you like, a new offspring. The north did not discard their method of building vessels, but they adopted from Mediterranean civilizations the oared type of propulsion which made for rapidity of transit in the East, and made, of course, for rapidity in the forays of Viking marauders. The lecturer showed well how important oared vessels were to the trade of early civilizations; and if the Vikings had been cast in a different mould, they might have carried on a torch kindled by Byzantine trade, and the culture which trade engenders. Unhappily, they were destroyers rather than creators, and I cannot believe that they evolved the noble vessels by which they are now chiefly remembered. Hitherto there has been, I admit, little enough encouragement to bridge the gulf that separates the civilization of the Levant from the barbarism of eighth-century Scandinavia. Yet archaeological researches are unearthing Byzantine coins along the North Sea coasts; and the same lines of inquiry are showing that when, in the ninth century, the Byzantines were excluded from the Western Mediterranean altogether by the Moslem conquest of Sicily, they forced new routes to the Baltic by the great river-ways of Russia, and by a great trunk-line that traversed the Adriatic and the Rhine. The growth of Venice is inexplicable until it is remembered that she played for Constantinople the same part that Marseilles played in the days of Imperial Rome. Students of Church architecture will not need to be reminded how Byzantine architecture got into France in the age of Charlemagne, and there does not seem much cause for astonishment if Byzantine naval architecture gave the Vikings their ideas.

The compromise between the ships of north and south, which enabled the Vikings to evolve their peculiar craft and traverse the seas from Egypt to America, brings me to my second point. I feel quite unable to support the lecturer in his contention that the wonderful development made by European ships in the fifteenth century is traceable to the direct influence of the Chinese junk. Mr. Laird Clowes has shown in words and in pictures how the mediæval ships that succeeded to those of the Viking age were beamier vessels, approximating, one may think, more nearly to the type described by Cæsar. The one-masted "round vessel" of Northern Europe in the thirteenth and fourteenth centuries is familiar enough to all students of sailing ships. How came it that they developed in the fifteenth century to the three-masted type which took Columbus to America and da Gama to India? That is the riddle to which the lecturer has given a Chinese answer. I for one cannot accept it. I believe the typical vessel of the late fifteenth century was, like her Viking predecessor, a compromise. It is impossible to prove this contention by archaeological evidence. Mr. Laird Clowes has demonstrated the paucity of authentic remains. But history does come to the help of archaeological research, and we do know that at the beginning of the fourteenth century the tables had been turned and the ships of Northern Europe were invading the Mediterranean. They came as pirates and they instantly asserted their superiority. As Mr. Laird Clowes has shown, Richard Lion Heart encountered a three-decker in the Levant at the time of the third crusade. It is practically certain that this

vessel was lateen-rigged throughout. In the Eastern Mediterranean lateen was still the fashion when the northern ships made their appearance. The northern ships brought a new sail-plan which the cities of the Western Mediterranean, Genoa and Pisa for example, were quick to adopt as soon as they had made due trial of its efficacy. But there was no case of substitution any more than in the evolution of the Viking ship. The Mediterranean states were convinced of the superiority of their hulls, and while they gave grudging admiration to the square sails and the seamanship of those who worked them, they had also for unnumbered centuries found the lateen sail sufficient. The clash of types, as was natural enough, again resulted in a compromise. The hulls henceforth were to be carvel-built after the immemorial custom of the south, and a lateen sail on the mizzen (or mizzens) assisted the vessel to answer her helm. On the other hand, the motive power or the driving power was henceforth provided—not by the balanced lugsails of Chinese craft—but by the square rig and the sail-plan of Northern Europe. In this way, I believe, was evolved the occidental ship of the fifteenth century without which the world would never have been explored.

The PRESIDENT: Mr. Heawood, the Librarian of the Society, has gone, or he would have spoken with great authority on the map ships. We have had an interesting lecture and discussion, and I would only touch upon one or two points. Major Fyers mentioned Minoan shipping, and I have some personal qualification for referring to that. So far as I know, there is no representation on any Minoan object of a ship which could possibly have been a sea-going vessel before the first Late Minoan period, and that, of course, is as late as, probably posterior to, Queen Hatshepsut. Minoan shipping, then, would not have priority over eighteenth-Dynasty shipping. With regard to the latter I have also some personal reason to know Deir el Bahari. I do not think it has ever been supposed that the ships were dragged overland to any port on the Red Sea, and there is no reason to suppose that there was any canal connecting the Red Sea and the Nile, such as was made at a later time. It is most likely that these ships of Queen Hatshepsut were built at some port upon the Red Sea, and that transport was effected from Thebes overland to the ships. However, it is extremely uncertain, whatever Maspero may have said, where Punt was, whether on the Somali coast or on the Arabian, or whether it was upon the outer sea at all. I quite agree with Major Fyers that the ships, as shown upon the walls at Deir el Bahari seem very unfit for ocean-going. They look as if they were built for river transit. What Mr. Laird Clowes said about Viking and other ships well illustrated the different ideas that existed even as late as mediæval times about what could venture on to the open sea and what not, but it has always to be remembered that a number of Nilotic river-boats during the Great War went round to the Persian Gulf, where they were wanted on emergency. I believe they all got there, which is an amazing thing. This was certainly one of the most curious features and side-shows of the war.

There is one other point on which I was most interested. Mr. Laird Clowes spoke of Fra Mauro's map, which was made in Venice. Although forty years had still to pass before Vasco da Gama rounded the Cape, that map shows a most life-like representation of the Cape. It has always been a puzzle how it was done, but I have no doubt that the general explanation is that the Venetians, venturing eastward into the Red Sea, while the Portuguese went down the other side of Africa, came into very intimate touch with both the Arabs and, what is new to me, possibly with the Chinese—I have to thank

Mr. Laird Clowes for that—and that Fra Mauro's accurate delineation of the east coast of Africa and the map including the island of Madagascar, of which Vasco da Gama was ignorant, and which he missed when he went up the coast and struck across to India, is due to communications between the Venetians and the Arabs, if not the Chinese. Certainly those illustrations which Mr. Laird Clowes put upon the screen seem to show that there were both Arab ships of the Mediterranean type, at any rate the Red Sea type, down in those southern waters and also ships of much heavier type differently rigged and with fore-and-aft castles, which may or may not have been China-built. However, I must not attempt to give a second lecture on a subject, however interesting, which was treated so admirably by Mr. Laird Clowes. I must ask you to express your gratitude for what has been a most careful and interesting paper, very much enhanced by the beautiful models Mr. Laird Clowes has been allowed through his official position to bring here, and for a near sight of which, not through the glass of a show-case, I am sure we are all exceedingly grateful. I beg to offer him your thanks.

A PERIPLUS OF THE PERSIAN GULF

Lieut.-Col. Sir Arnold Wilson, K.C.I.E., D.S.O.

Read at the Meeting of the Society, 10 January 1927.

I HAVE nothing new to say regarding the Persian Gulf: I have not broken fresh ground, nor explored untrodden wastes, nor can I add anything to the world's stock of knowledge. To reshuffle knowledge is rarely to increase it, and I should have been glad to use my own observations more and that of others less. "It is, however, not necessary"—to quote Doctor Johnson—"that a man should forbear to write till he has discovered some truth unknown before; he may be sufficiently useful, by only diversifying the surface of knowledge, and luring the mind by a new appearance to a second view of those beauties which it had passed over inattentively before."

In that spirit I address you, and in that spirit I ask you to follow me in the wake of Sindbad the Sailor, whose narratives, written in the ninth century, are part of the stock-in-trade of every well-conducted nursery. For there are beauties in "the Gulf," as I shall call it hereafter, not only of scenery but of animal life also, by sea and by land; nor are the people on its shores unworthy of admiration. Above all, its history is of absorbing interest to us. There is not an island, not a port, not a tract of water in the Gulf that does not recall some gallant or tragic incident in British annals. On Qishm Island, for example, lies William Baffin, discoverer of Baffin's Bay; at Hormuz and Bandar Abbas, Basidu and Bushire, and in a multitude of smaller ports on both sides, lie buried representatives of twenty generations of seamen and soldiers, British and Indian, and the bones of merchants not a few. I need not, therefore, offer any apology if I seem to refer at times less to the geography than to the history of a region in which I have spent some

fifteen years, and which has exercised over me a fascination which only those can understand who have lived for many years in primitive lands among ancient peoples.

The geological history of the Gulf may be said to begin in late Secondary times, when the Zagros range on one side and on the other the great plateau of Arabia rose out of the Cretaceous Sea. But Oman is really far older than this, for in those far-off timeless days the southern part of Arabia had already emerged from the waters that covered the face of the Earth: those blackened windswept countries have been land since land began. They are older than anything in Eastern seas, except the high places of Dravidia; no water has ever covered them; the sun has held and still holds unchallenged dominion over them. At first the Musandam *massif* separated the Gulf of Oman and "the Indian Ocean" from the Persian Gulf proper, which was connected with "the Mediterranean." In Miocene times the plateau of Arabia was elevated, and the Persian Gulf became an inland lake. After untold ages, still in the Miocene period, further violent movements took place; the Musandam promontory sank, and admitted to the Gulf the waters of the Eastern ocean. Ages passed, and man began to appear—the Hamitic peoples entered from Africa, the Dravidians, perhaps, pushed along the Baluchistan coast; from the north, at a much later date, came Aryan races, whilst Semitic tribes occupied the western and northern shores. But they were colonists rather than conquerors.

The very earliest records we possess of human activities in this region relate to commerce. The British Museum has a tablet from Ur of the Chaldees, near the present Basra, dated about 2000 B.C., which records the arrival by sea at Ur from Dilmun—which may or may not be Bahrain—of copper, wood of various kinds, diorite, and pearls. Dhufar, an outlying province of Oman, was the oldest and perhaps the most productive of the frankincense districts of Arabia, to which Milton refers when he writes:

"Off at sea north-east winds blow
Sabean odors from the spicy shore
Of Araby the Blest." *

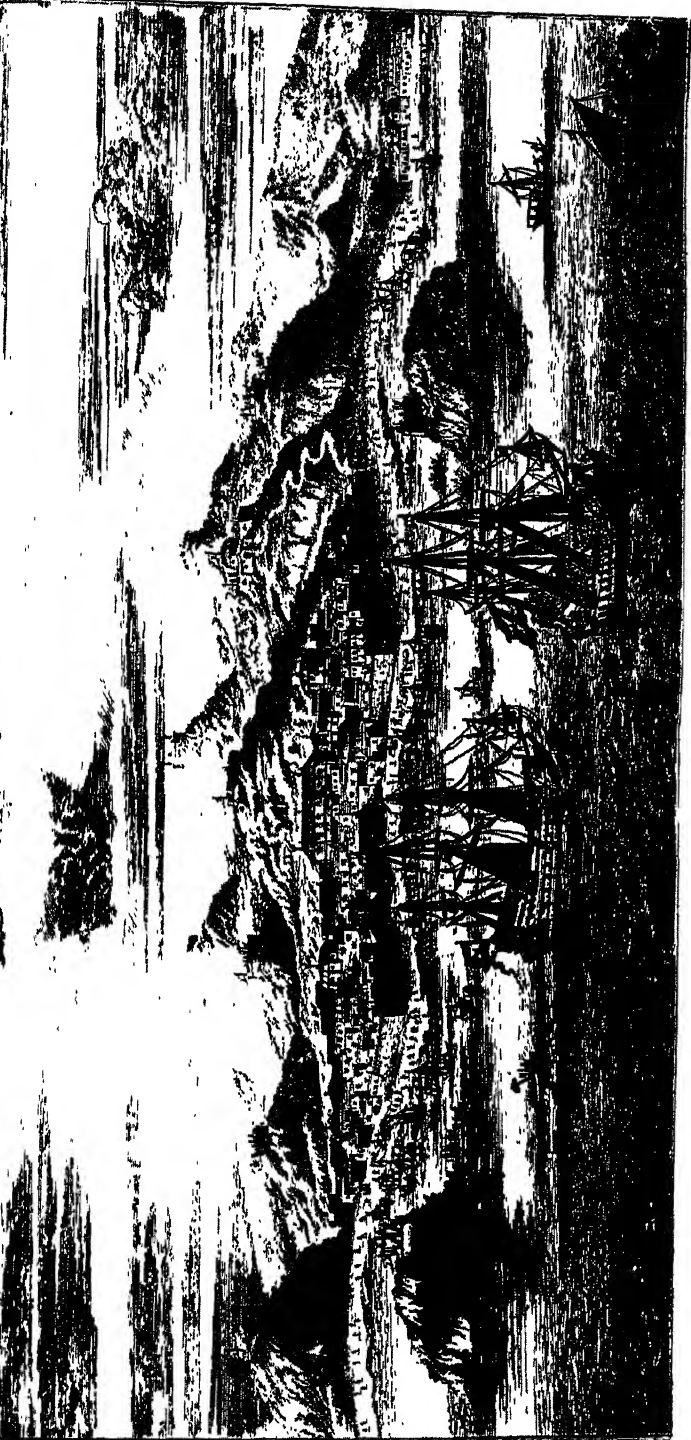
It was the Mount Sephar of Genesis, the *Cana* of the Periplus of the Erythræan Sea, "to which all the frankincense produced in the country is brought by camels, on rafts, and in boats."

The people of Dhufar are of the Qahtan tribe—the sons of Joktan mentioned in Genesis: they are of Hamitic or African rather than Arab types; and their country, though it borders on the "Empty Quarter," must get its fair share of monsoon rains.

One hundred miles farther along the coast lies Masira Island, the Sarapis of the unknown author of the Periplus, famous even in those days for its tortoises, and inhabited, then as now, by "settlements of

* *Paradise Lost*, IV. 62-64.

The Town of Muscat
in Arabia.



Muscat

From 'The Voyages and Travels of John Struys,' London: 1684



Bandar Abbas

From 'The Voyages and Travels of John Struys,' London: 1684

Fish Eaters, a villainous lot, who use the Arabian language and wear girdles of palm leaves." * Two thousand or more years have passed, but economic conditions have not changed, and are not likely to change, so it need not surprise you to know that when, in 1904, the British steamer *Inverdale*, of 2000 tons, with thirty souls aboard, was wrecked on the Kuria Muria Islands, the survivors landed at Masira and were massacred every one. But let us not judge these people too hastily, for when some vessels of the Spanish Armada were wrecked on the Irish coast only three hundred or so years ago (say ten generations) the crews were treated in the same way, and those that were not killed on landing, including some young boys, were collected later by Government officials and publicly hanged.†

A day's steaming brings us to Ras al Hadd: we turn north-westward and enter the Gulf of Oman. Some 5 million tons of shipping—95 per cent. British—make this cape every year, but it has no lighthouse, though every master of a ship would like to see one there, provided it be a powerful one and absolutely reliable. But the local tribes owe doubtful allegiance to the Sultan of Muscat, and a lighthouse would be a tempting opportunity for blackmail or worse.

Just round the corner, tucked away in a convenient bay, lies the port of Sur, nominally part of the dominions of the Sultan of Muscat, but in reality almost independent under its own chiefs. The physical features of the port closely resemble those of the town of the same name on the Syrian coast, and it may well be that the latter was so named by Phœnician traders, who, says Herodotus, "came to the Mediterranean, according to their own account of themselves, from the Persian Gulf." The position of Sur, the first sheltered port on the Oman coast touched by dhows from India or Africa, has invested it throughout the ages with peculiar importance. Until the advent of steam, the high-pooped *bums* and *batis* manned and owned by Suris were to be seen in due season in every port on the Indian Ocean. Nowhere were better or faster ships built than on the Oman and Arab coast of the Gulf, no nation had more skilful sailors or more enterprising merchants. But steam ruined the industry, and dealt a blow at the maritime Arabs from which they have never recovered, for they have neither the capital, the knowledge, nor the resources to stand up against European steam vessels. Sur was long the centre of the slave trade from Africa, and the suppression of the traffic proved even more difficult here than at Muscat, despite the vigilance of patrolling cruisers, and the dhows plied a remunerative trade, as often as not under cover of the French flag. Retribution overtook the Suri slavers on the discovery of the headquarters of the traffic in Samuco Bay on the East African Coast, in 1902: a Portuguese naval expedition broke up the

* Schoff, 'Periplus of the Erythræan Sea,' p. 35.

† Lord Ernest Hamilton, 'Forty Years on,' p. 220.

camp and captured the principal delinquents, who were brought to trial and sentenced to long terms of imprisonment. Sur has languished ever since, but is still a centre of some importance and, by virtue of its geographical situation, is a serious rival to Muscat and Matra.

Another 100 miles up the coast lies Muscat, one of the most picturesque harbours in the world. The town lies crammed into a narrow recess at the foot of the hog's-back range of Jabal Akhdhar, or the "Green Mountain" of Oman. The harbour is a lake of deep blue, where shoals of fish disport themselves in the clear water; the houses stand at the very edge of the surf, and the ruined fortresses of Jalali and Mirani, grim reminders of the great days of the Portuguese Empire in the East, crown the promontories that command the harbour on either side. A gap in the rocks, where a side breeze comes in from the ocean, renders life less insupportable during the appalling heat of the summer months.

An Arab writer (Abdur Razzak) has left on record the following rhetorical description of his own feelings of the climate here. "The heat of the sun," he says, "was so intense that it burned the ruby in the mine and the marrow in the bones: the sword in its scabbard melted like wax. . . . In the plains the chase became a matter of perfect ease, for the desert was filled with roasted gazelles." Lord Curzon, in more matter-of-fact vein, states that a sun temperature of 189° F. has been recorded. "The rainfall is only 3½ inches in the year, and the whole of this falls within a period of two or three weeks." In such conditions, it is not surprising that the genuine Arab has been swamped here in the African type.*

Albuquerque, in 1506, on his way to conquer Hormuz—which he regarded as one of the two key positions of empire in the Indian Ocean—after fruitless negotiations with the rulers of Muscat as to the amount of tribute to be paid, sacked and burned it, down to the very mosque and shipping in the harbour. Then commenced the strangle-hold of the Portuguese, which they did not relinquish until 1650.

Since then Muscat, with its sister port of Matra, the heart of the sultanate of the same name, has seen rulers of much ability, and has in consequence maintained its independence. It has figured largely in the efforts this country has made in the suppression of the slave trade and of the arms traffic. There is a British Admiralty coaling station at Muscat, about to be replaced by an oil-fuel station; let us hope that the Admiralty will take very special care to ensure that no oil is suffered to leak from the tank or barges, or be spilt when ships are refuelling, for it would need but little oil on the shores of the bay to make life intolerable, and fishing impossible, and the people at Muscat live mainly on fish.

It was of the people of Muscat that a boatswain of the Royal Navy, following the instructions of the Admiralty to make, when visiting

* 'Persia and the Persian Question.'

strange places, a report of the manners and customs of the inhabitants, penned the famous saying, "As to manners they have none; and their customs are very beastly."* In fairness to the place, however, it must be admitted that such a description of the people of Muscat is untrue and was probably never otherwise than libellous, and Sir J. Malcolm is careful to record that his informant described the author as "a blunt fellow of a master, an excellent seaman, but who troubles himself very little with matters on shore," and admitted that he only made the entry in despair, having evaded the order to do so as long as he could.

Shaping our course almost north-westward, in view of the palm-belted Batina plain, we reach at last the rocky extremity of the Akhdhar range. The rocks of Oman are Archæan, the very foundations of the world; yet even Oman is changing—rising ever so slowly, as the shelf or ledge around Muscat harbour and elsewhere shows. But time was when the hills were sinking and, at Musandam, which we now approach, their outposts have been cut off and stand knee-deep in the invading waters. Some of these sentinel islands, almost overwhelmed by the sea, still keep watch, and tear the vitals of ships which venture over them. Two such rocks there are here, like Scylla and Charybdis, between which lies a deep channel and a tempting short cut into the Gulf; but through the gap runs so fierce a current that not even a steamer can breast it without risk of destruction against these terrible crags; all masters are warned against attempting it, but some must needs, now and then, try their luck. Thévenot (1603) records how "some English one day, being half drunk and having a good Wind, would needs in a frolick sail through that Channel, but so soon as they were got in, the Wind failed them, and they were in great danger of splitting against the Rock; however they preserved themselves with Renders and Poles, but not without a great deal of trouble, and were sufficiently scared before they got out again: if it had blown hard, they must infallibly have been split."

Standing athwart the Strait of Hormuz, these two rocky islets are known to the Arabs as *Salamah wa banat-ha* (the Pilot's daughters), but to us by a name given them by British tars two hundred years ago—The Quoins, an old English word for "wedge," which they strongly resemble, derived from similar Latin and Greek words. On the smaller of the two stands a lighthouse, the first met with on our way excepting minor shore lights at Muscat, Jask, and Charbar. Built and, until recently, kept at the joint charge of the British and Indian Governments, it is, except for the small lighthouse at Muscat and shore lights at Jask and Charbar, the first public indication of our marine interests in these waters and of our acceptance of certain responsibilities consequent thereon.

* Malcolm, 'Sketches of Persia' (1861), p. 9.

To the south lies the unscalable headland of Musandam, the *Mons asabo* of Ptolemy, and the "headland projecting far out into the sea, about a day's sail distant," probably descried first by European eye when Alexander's admiral, Nearchus, in 325 B.C., reached the Strait from the mouth of the Indus. "Those who understood the situation of the Country," writes Arrian, "affirmed that this Promontory belong'd to Arabia, and was call'd *Maceta*, and that Cinnamon, and other fragrant Spices were convey'd thence to the Assyrians." The same promontory was the *Maka* of Eratosthenes. According to Juba, navigation in this locality was regarded as impracticable on the Arabian side "on account of the rocks." When Onesicritus, the pilot of Nearchus, viewed this promontory, so alluring did it appear that he gave orders that the fleet should steer directly thither, until he was seasonably reminded by Nearchus "that he must have a shallow Memory, if he did not remember for what Purpose the Fleet was ordered to pass those seas." *

The shores of the Musandam promontory are inhabited by the Shihuh, a very curious and primitive race, who speak a dialect unintelligible to Arabs, and on whom we may, I hope, expect fresh light before long. Within Musandam, piercing its very heart, are the wondrous fiords of Elphinstone and Malcolm Inlets, probably the hottest places on Earth. On an island in this hell of rock and sea was once established a submarine cable station—but not for long, for neither the British nor Indian staff could endure the climate and the total lack of all amenities. Two members of the staff having succumbed in as many years, and the protests of the survivors being disregarded by Government, they are believed to have set fire to the station, as a result of which a new arrangement was made, involving relay stations at Jask and Hanjam. There were times not long ago when most British Consuls and Political Agents in the Gulf wished that their predecessors had taken equally heroic measures, for almost everywhere in the Gulf they were very badly housed, and provided with none of those amenities, such as ice, electric light, and fans, which do so much to render life in hot countries agreeable, though not of necessity more healthy.

Jask, in olden days, says Herbert, "famous in nothing except her prospect into the Gulf of Persia," is now of importance as the point of junction of the ocean cable and the land line from India. Here the traders of the East India Company landed their first cargo of goods in Persia and started that commercial intercourse with the country, which was later on to have such far-reaching consequences. Cæsar tells us in his Commentaries, that "the merchants" gave him the information that led to the invasion of Britain. The East India Company harboured no such design, and our early conflicts in the Persian Gulf were not with the inhabitants, but with the rival European powers, seeking a monopoly

* Rooke, 'Arrian's History of Alexander's Expedition,' p. 265 f.

of trade there. At Jask was killed, in a sea-fight with the Portuguese, a worthy Englishman, whose epitaph Herbert writes as follows :

“ Here lies buried one Captaine Shilling
unfortunately slaine by the insulting
Portugall: but that his bones want
sence and expression, they would tell
you the earth is not worthy his recep-
table, and that the people are blockish,
rude, treacherous, and indomitable.”

From Jask the land telegraph lines run along the Makran coast to Karachi. To maintain them, as has been done by the I.E.T.D. continuously for nearly sixty years, along this torrid shore inhabited by tribesmen whose sole means of showing their independence was to cut the wire, is no small feat. It has not been done without loss of life, but the record of this section of the Telegraph Department is, on the whole, creditable to both sides. A cable runs eastwards as far as Charbar and westwards to Hanjam, where it is relayed, and connected by another short length of cable with Bandar Abbas. At Hanjam is a wireless station, enabling ships to announce the probable date and hour of their arrival at any port in the Persian Gulf except those on the Trucial Coast.

To the north of the Quoins lies Larak, and still further north Hormuz. The stretch of water here is the key of the Gulf, and Malcolm Inlet is the pocket in which we may keep the key, for in that majestic solitude of torrid mountains and deep water the whole British Fleet could ride safely at anchor, should need arise. Hormuz, once an emporium comparable to modern Bombay, is now almost uninhabited. Barren it always must have been, for “ the island has no fresh water, save what the fruitfull Cloudes weepe over her, in sorrow of her desolation, late so populous,” says Thomas Herbert, who was there not long after the Portuguese were ejected by a joint force of Persians and English in 1622, in the days of Shah Abbas the Great. The sole commerce of Hormuz to-day is in red oxide for export and rock salt for local use, but it has been the scene of great adventures. Hormuz was already important as an emporium (as witness Friar Odoric, 1330) before it was finally conquered, in 1515, after more than one effort, by the great Albuquerque, who recognized in it one of the key positions necessary for the establishment of a Portuguese Empire in the East. On the expulsion of the Portuguese, the once famous city was soon stripped of all that was of value and left to a natural decay ; and the small island whose wealth and luxury were once proverbial, which is said to have boasted a population of 40,000 souls, is now a barren rock inhabited by some 200 sturdy families of fishermen, living in huts under the shadow of the old Portuguese fort. It is vain to speculate on what might have been the course of events in the Gulf had the English not joined forces

with the Persians against the Portuguese; it is sufficient to recognize that much was at stake on the day on which that decision was made.

On the destruction of Hormuz, Shah Abbas formed magnificent plans for a great seaport on the mainland, to bear his name: Bandar Abbas rose from the ashes of Hormuz, and to the newly founded port was transferred the trade of the dead city. The climate of the town has an evil reputation: the learned Doctor Fryer mentions that the British sailors of the East India Company "stigmatized this Place for its Excessive Heat, with this sarcastical Saying, *That there was but an Inch-Deal betwixt Gomberoon and Hell*";* but, to quote Lovat Fraser, "it has its compensations, and when its sleepless nights are forgotten, the vision of Hormuz across the water, incarnadined in the sunset and glowing like a jewel, lingers in the memory."†

Bandar Abbas for over two centuries maintained its supremacy as a commercial port, thanks to good land communications with the capital at Isfahan, and to its anchorage, which was convenient and good for the ships of those days. But to-day ships must anchor a mile or two from land, and there is no shelter from most winds; whilst the Bushire-Shiraz route, which is more or less passable for wheels, has tended to divert traffic, with the result that trade in Bandar Abbas has not increased as at some other ports.

A few miles east of Bandar Abbas lie the rich gardens and date groves of Minab, which first gladdened the eye of a European in 325 B.C., when Nearchus put into the creek on his voyage up the Gulf and learnt the whereabouts of Alexander's army. "Here they arriv'd," says Arrian, "at a town called *Harmozia*, at the Mouth of the River *Anamis*, in a Country pleasant and agreeable, and abounding in every thing, except Olives. Here, going on Shore, they gladly refresh'd themselves, after so many, and hard Labours, and joyfully reflected on the various Accidents they had encounter'd, during the whole Voyage."‡ At Minab died, two thousand years later, Maani, the Syrian wife of the traveller Pietro della Valle. She does not lie buried here, however, for he caused her body to be embalmed and carried it about with him for four years until, on his return to Rome, he had the mournful satisfaction of giving her honourable interment in the cemetery of her ancestors. He himself died in 1652.

Leaving Bandar Abbas and taking at first a south-westerly course, we soon have Qishm island to starboard, and separated from the mainland by Clarence Strait. We are now well within the Gulf itself. The first notice of the island seems again to be that of Arrian, who says: "And setting sail (from Harmozia), in a run of 300 stadia they passed a desert and bushy island, and moored beside another island which was

* 'Fryer's East India and Persia,' Hakl. Soc., 2, 165.

† 'India Under Lord Curzon and After,' 1911.

‡ Rooke, 'Arrian's History of Alexander's Expedition,' chap. xxxiii.

large and inhabited—the small desert island was called *Organa* (Jerun, Hormuz); and the one at which they anchored *Oarakta*, planted with vines and date palms, and with plenty of corn.* The Portuguese had a strong fort on the side of Qishm opposite to Hormuz, constructed to guard the water and other supplies upon which Hormuz depended for its very existence. It was at the storming of this fort by a combined English and Persian force that the discoverer of Baffin's Bay met his death. Purchas, in 'His Pilgrimes,' quaintly tells us that "Master Baffin went on shoare with his Geometrical Instruments, for the taking the height and distance of the Castle wall, for the better leavelling of his Peece to make his shot; but as he was about the same, he received a small shot from the Castle into his belly, wherewith he gave three leapes, by report, and died immediately." He was buried on the island.

Basidu, or "Bassadore," as it was known to British sailors, is on the north-western extremity of Qishm, exposed to all the winds that blow. It was ceded to the British Crown in 1817, having been selected, after the suppression of piracy on the Arabian coast, as a base for the squadron responsible for keeping order in the Gulf and protecting trade. The vision of a convenient headquarters for naval activities soon vanished, however, for the summer, with its intense heat, proved detrimental to the health of the occupants, and the station was abandoned in 1823. Only a native agent was left there to guard the stores that had been accumulated; but the British flag still flies there on occasions.

About 25 miles due south of Qishm lie the Great and Little Tanb islands, known to our forefathers as "The Tombs." On the larger of the two is a fine lighthouse of the same power as that on the smaller Quoin. A barren island this, standing stark out of the water, inhabited—except for a few months when cattle belonging to the Shaikh of Sharja, to whom the island belongs, are brought from the Arabian side to graze—only by snakes, seafowl and, in spring, by the ubiquitous swallows, which build their nests every year in the quarters of the lighthouse crew, well knowing that from Ireland to Cape Comorin no man will molest them, be he Persian, Arab, Turk, Indian, or European, for their presence brings good luck to the house. This belief is of great antiquity.† The lighthouse crew, mostly Indians from the Ratnagiri district, here and on the Little Quoin rock, must surely find time lie heavy on their hands, for the lighthouse tender visits them only once every few months, bringing food, water, and a relief crew. Yet there is no lack of competition for the duty!

Close by the Tanb islands, in 1800, the East India Company's cruiser *Sylph*, a schooner of 18 tons, was attacked by Jawasmi pirates. Commanders of British vessels in those days received from the Bombay Government peremptory orders, any infringement of which would involve

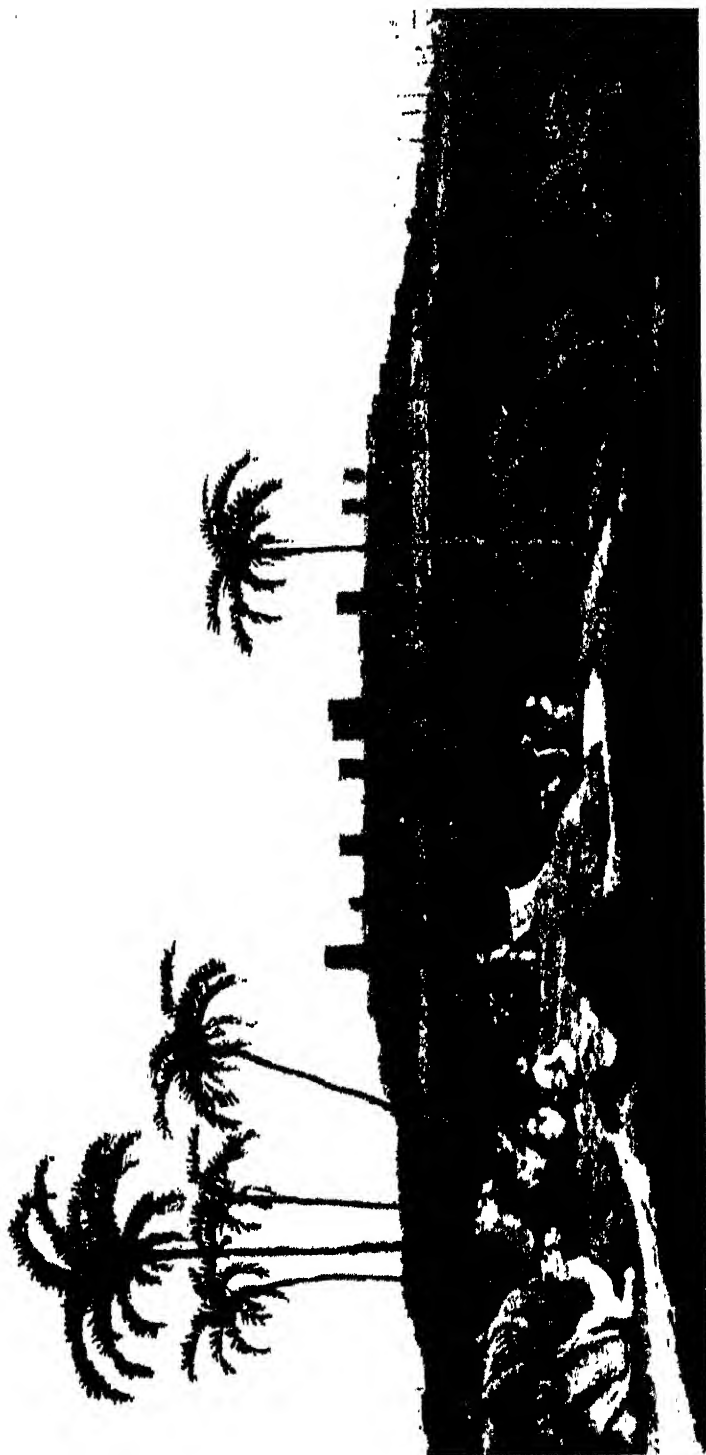
* McCrindle, 'Arrian's Account of the Voyage of Nearchus,' 1879.

† See Sophocles, 'Elect.', V., 149; also Sale, 'The Koran,' p. 499.



Cape Musandam

From James Morier's 'Journey through Persia,' 1812



Bushire

From James Morier's 'Journey through Persia.' 1812

dismissal, on no account to fire on Arab craft until they first opened fire. These orders placed a small cruiser absolutely at their mercy, for the Jawasmi cared not to engage in a gunnery duel with British seamen; their tactics consisted in running alongside an enemy and throwing on to the deck of the vessel some hundreds of men armed to the teeth, thus bearing down all resistance.

The dhows in this case quickly ran alongside, with their overhanging prows; in an instant the decks of the *Sylph* were swarming with desperadoes who, with the name of the Prophet on their lips and a thirst for Christian blood in their hearts, commenced a wholesale massacre, and in a few minutes almost the entire crew had perished, fighting desperately. The arrival of a large sister ship prevented the Jawasmi from killing the rest and sinking the ship. This and similar outrages at length opened the eyes of the Government of Bombay and Court of Directors to the absurdity of the instructions enjoined upon naval officers. The public voice called for the punishment of the piratical horde, but it was not until the blood-red Jawasmi flag was seen even on the coasts of India that the authorities completely awoke to a sense of shame.*

The home of the Jawasmi was that stretch of low shore running southwest of Ras Musandam and due south of the Tanb islands; here lie sweltering beaches and yellow sands, a desolate windswept shore, and a tangle of narrow creeks and shallow lagoons, only partially explored even in this day, but then hardly known at all. Navigation is difficult even for native craft, and such a locality was well calculated to afford protection to the pirates and to render their suppression exceedingly difficult. The Jawasmi headquarters was the town of Ras al Khaima, formerly known as Julfa, on a sandy spit enclosing a deep narrow bay protected by a bar. Other Jawasmi resorts were Sharja and Abu Dhabi. Thence, inspired largely by Wahabi tenets, they made their sallies, at first confining their activities to native craft, but, as time went on and they waxed in strength, fearing not to attack even British vessels. A naval and military expedition despatched in 1809 from Bombay to Ras al Khaima, with the object of destroying the power of the Jawasmi, succeeded only in keeping them quiescent for a time, and it was not until 1819 that conclusive action was taken. A powerful armament proceeded again to Ras al Khaima and, after a stiff resistance and a siege of six days, the town was captured, the Jawasmi boats burnt, and the forts razed to the ground. Negotiations followed for a treaty of peace, which was concluded in 1820, and the "Pirate Coast" became the "Trucial Oman." That treaty has never been broken; and, with one or two exceptions, the present chiefs of the Trucial Coast are the direct descendants of those who signed that treaty, and they enjoy a not less ample independence than their fathers enjoyed. The reason why the Persian Gulf has enjoyed peace for a hundred years is, that we

* Low, 'History of the Indian Navy,' 1877.

thoroughly defeated the enemies of law and liberty, before we made a treaty.

The outcome of such vigorous but somewhat tardy action was the final pacification of the Arab coast of the Gulf and the abolition of overt acts of piracy : our task is not even yet complete ; isolated acts of piracy occur almost every year, but these sporadic cases are usually swiftly punished, and on the whole our work stands good. Retired pirates from being raiders of the pearl fleets of Bahrain have become pearl divers on the adjoining banks—also a gamble which adds a zest to their hard life.

Retracing our steps and pursuing our course from 'Tanb, a few hours' steaming bring us opposite Lingeh on the Persian coast, now a shadow of its former self. Time was when, as a centre for the collection and export of pearls, it rivalled even Bahrain ; the headquarters of this business is now on the Arab coast, where the local authorities know better than those in Persia how to foster trade and to encourage local initiative. Viewed at a distance the town could almost claim to be the prettiest place on the Gulf, with its houses and minarets backed with palms and the tinted mountains behind ; but this vision of beauty hardly bears close inspection.

A few hours bring us to Qais island, where lies anchored a lightship. We have reason to believe that this island once contained a flourishing city, though the remains now consist of little more than mere mounds of stone, blocks of masonry, and ground strewn with fragments of pottery and Chinese porcelain. A "great emporium of trade" is indicated by various of the mediæval writers, though it is somewhat difficult to understand how it flourished, since there is no sheltered harbour and the anchorage is open to one or other of the prevailing winds. Qais appears to have been at the height of its glory when visited by Benjamin of Tudela between 1164-1173 A.D. He says that, though there was no agriculture owing to the absence of springs, so that the inhabitants were obliged to drink rain-water, it "is however a considerable market, to which Indian merchants and those of the islands bring their commodities ; while the traders of Mesopotamia, Yemen, and Persia import all sorts of silk and cloths, flax, cotton, hemp, etc., which articles form objects of exchange ; those from India import great quantities of spices, and the inhabitants of the islands live by what they gain in their capacity of brokers of both parties." Qais seems to have lost its importance—for what reason it is not known—somewhere in the fourteenth century, and its trade passed to Hormuz.

There is a legend, reminiscent of Whittington and his cat, regarding the early settlement of the island. The following is one of many versions : One Keis, the son of a poor widow in Siraf, embarked for India, with his sole property, a cat. He fortunately arrived at the island at a time when the palace was so infested by mice or rats that they invaded the

king's food, and persons were employed to drive them from the royal banquet. Keis produced his cat, the noxious animals soon disappeared, and magnificent rewards were bestowed on the adventurer of Siraf, who returned to that city, and afterwards with his mother and brothers settled in the island, "which from him, has been denominated Keis, or, according to the Persian, Keish." *

Qais had succeeded Siraf in the proud place of principal emporium of the Gulf somewhere in the eleventh century. The site of the latter place has been identified with that of modern Tahiri, situated some 70 miles farther along the coast. West of Tahiri are to be seen the ruins of the old Muhammadan port of Siraf, extending for a mile or more along the shore and up the slope of the foothills. Farther inland, in the slopes of ravines which come down from the hills, are other remains apparently pre-Islamic; in one place the hillside over a space half a mile square has been worked into tiers of remarkable troughs, the origin and purpose of which so far remain unexplained. The earliest reference we have to Siraf is in the ninth century in the ancient accounts of India and China by two Muhammadan travellers who went to those parts and who tell us that it was then the chief mart of the commerce between West and East as far even as China. Istakhri (tenth century) tells us: "the most important town of the district . . . is Siraf, which is almost as large as Shiraz; its houses are of teak wood or of other wood from Zanzibar; they have several stories. The town is situated on the sea coast, is covered with fine edifices and is very populous. . . . The imports are aloes wood, amber, camphor, precious gems, bamboos, ivory, ebony, paper, sandal wood, and all kinds of Indian perfumes and drugs." Here Arab dhow and Chinese junk anchored side by side. That the trade must have been considerable is evident from the receipts of customs of the port, which, according to Ibn ul Balkhi, amounted to 233,000 gold dinars.

Siraf, Qais, and Hormuz, in association with old Basra, epitomize the commercial history of the Gulf during the Muhammadan era. They flourished successively at a time when the Persian Gulf still formed part of the principal route of communication and trade between West and East—before the "sea-way" round the Cape was found.

We will now cross the Gulf in a due south-westerly course, to the Bahrain islands, which lie "between the two seas" in the bay separating Qatar from Hasa. Two acetylene gas buoys maintained by the British Government guide our ship to the inner anchorage of Manama, the commercial capital of the principality. The Shaikh resides mostly at Muhurraq on the smaller of the two islands, possibly the *Tylos* of the classical writers. Aged nearly ninety, Shaikh Isa bin Ali al Khalifa, K.C.I.E., the doyen of the Arab chiefs of the Gulf, first became independent ruler with the support of the British Government—as against

* *Tarikh i Wesaf*, of Abdallah Shirazi (thirteenth to fourteenth century).

Turkish pretensions to sovereignty—in 1869. He handed over the reins of office to his eldest son, Shaikh Hamad, under pressure, three years ago.

At Bahrain we are at the centre of the pearling industry. The best pearls in the world come from the Gulf. The number of operators personally engaged in the industry throughout the Gulf is 75,000 at least, and this number does not take in the reckoning the families of the operators or the very numerous merchants whose funds are invested in the business. The value of the pearls exported in 1904 was at the lowest computation £1,500,000; at the present day the value is probably at least £3,000,000 a year, of which Bahrain gets the lion's share. The richer merchants are mostly Arabs, who are almost as familiar with Bombay as with Bahrain; one and all are experts in pearls, and many now own motor cars, the possession of which, together with the installation of electric light and fans, may make them less inclined to hanker after the garish pleasures of Bombay.

An interesting field for investigation is open to the archaeologist in Bahrain island, where, near the Arab village of Ali, are to be found tumuli of ancient but uncertain date, covering several square miles. For over a generation past there have been tantalizing accounts of these: Theodore Bent in 1889, Captain Durand in 1879, and Major (now Lieut.-Col.) Prideaux in 1906-7, had in turn excavated among them, but nothing definite was known of their age. It was thought possible that the tumuli were connected with a migration from Egypt; so in 1925 Mr. E. Mackay, who had worked in Mesopotamia, was asked to excavate further at Bahrain for the British School of Archaeology. He opened up some thirty-five chambered tumuli, but the results were scanty, as was the case with the previous excavators. The form of a bronze spear-head indicates about 1200-1500 B.C. as the period, and the pottery would agree with such an age. Some of the pottery is of forms known in Mesopotamia, but most of it is independent, and shows what was the style in the East Arabian civilization. The back of an ivory statuette is of good workmanship, but not like anything known elsewhere. It seems likely that the island was a cemetery for bones transferred from the mainland after the bodies had decomposed.*

One is prompted to surmise that the island may have been the burial place of the *scala* of ancient Gerra, the site of which may well have been near the present-day port of Ujair (Oqair), on the mainland of Hasa, as suggested by Philby and Cheesman.

Bahrain has for many years been the centre of American missionary enterprise in the Gulf: other places at which they work are Kuwait, Basra and Muscat. It will be within the recollection of you all that Christian missions in China have recently been denounced. I have not seen missions at work in China, but I have seen them at work in

* Flinders Petrie, in *epistola*.

Arabia, Mesopotamia, and Persia, for the last twenty years, and I should not like to speak about the Persian Gulf without bearing testimony to the wonderful work they are doing. I do not suppose they have made converts in appreciable numbers, but they have, by their labours, assisted by the high standard of rectitude displayed by British officials and British merchants, profoundly modified the Arab outlook in ethical matters. The Arab is a Muhammadan first and an Arab after, like all Islamic races; he regards Europeans, likewise, as Christians first and foremost. He knows, perhaps better than we do, that our standard of conduct has its basis in the religion of our country; he respects our standard of conduct, and without adopting our religious views he tends, unconsciously, to recognize our standard of conduct as higher than his. He does not despise, but greatly respects, those who devote their lives to spreading, by example and by teaching, the Christian religion. There is no greater influence for good in the Gulf than the Christian missions; no Europeans are so universally respected as are the missionaries, such as Zwemer, Van Ess, Harrison and Mylrea, and those who decry foreign missions do less than justice to themselves and harm to our good name.

To the east of Bahrain lies the Qatar peninsula, of which Palgrave's description is the best extant. He says, "To have an idea of Katar, my readers must figure to themselves miles on miles of low barren hills, bleak and sun-scorched, with hardly a single tree to vary their dry monotonous outline: below these a muddy beach extends for a quarter of a mile seaward in slimy quicksands, bordered by a rim of sludge and seaweed. If we look landwards beyond the hills, we see what by extreme courtesy may be called pasture land, dreary downs with twenty pebbles for every blade of grass." Like Bahrain, Qatar owes its existence to a limestone fold so gentle that the ground-level in the centre of the peninsula is only 250 feet above the sea.

In these waters "schools" of porpoises are frequently met with; they leap out of the water towards us till the sea is churned up and its surface flecked everywhere with their shining bodies. Arrived within a few hundred yards, they turn off, but a few remain to gambol just ahead of the ship, keeping only a few inches from her bows and maintaining their position at 14 knots with the utmost ease. At night they may be seen as clearly as by day in the cold phosphorescent light created by the movement of the ship. And, if we are lucky, we may witness one of those remarkable atmospheric phenomena which occasionally occur in the Gulf, more particularly west of the Quoins. Such an appearance was observed by passengers of the *Eden Hall* in March 1908, near Hormuz. "It was dark at the time, with a very glassy sea, when it suddenly appeared as if some one was turning flashlights on the ship. It turned out to be waves of light wheeling round the ship in the air just over the sea, and not actually on the surface. The phenomenon was

observed for twenty minutes." * A similar spectacle has been observed in the Malacca Strait.

A brief reference to the temperature of the surface waters of the Persian Gulf may not be altogether out of place at this point. Fanciful statements have been made with regard to meteorological conditions in the Gulf: it has been alleged, for instance, that the temperature of the water rarely falls below 33° C. all the year round. Happily matters are not so bad as that. According to available data, at the mouth of the Shatt al Arab it actually falls as low as 15° in February, and in August rises to a mean of 32°; frequently it reaches 34·5°, and has been known to touch 36°—the temperature of a warm bath! Thus the variation throughout the year is as much as 17°. In the Indian Ocean the corresponding variation is only 6–7°.† Again, the salinity of the surface water (to 25 metres depth) of the inner Persian Gulf is high compared with that of the outer ocean. A salinity of 40 per 1000 has been observed in the month of February at Bushire, similar to conditions in the most northerly part of the Red Sea. But tests have shown that, especially at the head of the Gulf, the salinity varies considerably—in summer it is low, and in winter high. There may be other factors, *e.g.* rainfall, but the chief cause of the difference between the salinity in summer and winter of the surface water, in this locality, seems to be the discharge of the Shatt al Arab; the decrease in salinity during May and June synchronizes with the flood of the Euphrates and Tigris rivers.‡ The subject suggests a useful field of inquiry.

A hundred miles, almost dead north of Bahrain, brings us to Bushire, the headquarters of our political influence in the Gulf. We have to come to anchor 6 miles from the shore, unless our draught and the tides enable us to reach the inner anchorage 3 miles nearer; both anchorages are marked by lighted buoys, and a further mark is a powerful light on the flag-staff of the Consulate-General. A desolate place Bushire appears from the sea, but few spots in the Gulf are more popular with Europeans. It is virtually an island separated from the mainland by 9 miles of mud flats: it is the *Mesambria* of Arrian, "a peninsula, wherein were many gardens and all kinds of trees that bear fruit," and was visited by Alexander's fleet.

Here lives the Persian Governor of the Gulf Ports and the Belgian Director of Customs; and here, in the inner harbour, riding at anchor, is to be seen the *Persepolis*, a German-built vessel, sole remnant of Nasir ud Din Shah's navy, now for sale. The quarantine officials, Englishmen—for this service is run by us on behalf of the Persian

* See further *J.B.N.H.S.*, 1917, xxv.; and *Geogr. Journ.*, 61 (1923), p. 66.

† G. Schott, "Geographie des Persischen Golfes und seiner Randgebiete," *Mitt. Geogr. Ges. in Hamburg*, 1918, 31.

‡ G. Schott, "Der Salzgehalt des Persischen Golfes," etc., *Ann. der Hydrog.* 1908, 36.

Government - come on board, sometimes by sailing craft, sometimes in a crazy launch which is all that the greatest naval Power in the world provides for its Chief Representative in these waters, sometimes in an almost equally derelict launch of the B.I.S.N. Company. Prudent passengers will elect to go ashore by sailing craft if it be rough. Bushire owes some of its importance to the fact that it is the terminus of the most frequented and shortest road from the coast of the Gulf to Shiraz and the interior of Persia.

The derivation of the name Bushire has for long been the subject of controversy. The popular derivation from Abu-Shehr is, for etymological reasons, unlikely to be correct. Dr. Herzfeld, who has made a special study of geographical sites and names in Sasanian times, suggests that the name is some compound of *B . . .* and *Ardashir*, but not "Bakht," as suggested by Curzon. Towns, he says, were assigned names connected in some way with the kings of the dynasty, cf. Riv-Ardashir (Reshire) and Ram-Hormuz.

It has been known for some time that the island (or peninsula) of Bushire offers a worthy field of investigation for the archæologist, and something had been done in a perfunctory way to reveal its secrets. It was not until 1913, however, that M. Pézard made excavations which revealed the historical parallel of the site of Sabzabad with Susa; and he was able to report that "the excavations at Bushire demonstrate that the region was occupied at a very remote epoch by a population, possibly proto-Elamite (but in any case very primitive), belonging to the Eneolithic age." During the Muhammadan era, the site of Sabzabad appears to have been abandoned for the west of the peninsula, where arose the ancient port of Reshire, itself abandoned a century ago, as shipping increased in size, for the present Bushire.

Weighing anchor and taking an almost due north-westerly course for the head of the Gulf, after about 30 knots, we pass within sight of Kharag and the smaller island of Khargu. The larger is not more than 12 miles in circumference, and consists of barren table-topped hills which rise to 250 feet. Though of small extent, Kharag has figured conspicuously in the Gulf history. In 1753, it became the headquarters of Dutch commercial activities in the Gulf, after they had abandoned their factory at Bandar Abbas and had been virtually expelled from Basra; but they held it only for a few years until, in fact, they were ousted by that notorious feebooter and pirate Mir Muhanna of Bandar Rig, whereupon their influence in the Gulf came practically to an end. The English next had a short but precarious hold upon the island, but relinquished it to its native owners as being too troublesome, and it became a convenient haunt for pirates. Later, the English twice occupied Kharag as a base of operations against the Persians during their attacks on Herat—in 1838-42 and in 1856-7; and more than once was the proposal put forward to make it the British Headquarters in the Gulf. Even to the

present day the pilots for vessels making the passage across the bar of the Shatt al Arab are mostly inhabitants of Kharag or of Bandar Rig on the mainland.

Kharag, too, seems to have a history stretching back into the dim past; it holds rock-cut tombs, some sixty in number, regarding which Professor Herzfeld—who examined them recently—says the two larger ones are catacombs of the third century with peculiar architectural features. Crosses, typically Nestorian in form, cut in the walls, are still visible, and there are almost obliterated remains of inscriptions in vertical Syriac script. The conclusion is that the tombs are Christian.

During the war, Kharag was extensively drawn on by the Expeditionary Force in Mesopotamia for road metal. The quarries have recently been reopened by the Anglo-Persian Oil Company, and during the first year and a half over 40,000 tons of stone were shipped to Abadan. The only other industry of any importance is pearl fishing, in which about a hundred men are engaged. Nearly opposite Kharag lies the small port of Ganawah, from which the same company have built a road some 60 miles inland, to localities where explorations for oil are in progress.

Twelve hours' steaming from Bushire brings us to Kuwait Bay, sometimes described as the best harbour in the Gulf, though, as the late Shaikh Mubarak (who became its ruler in 1896) once remarked to a globe-trotter: "It may be a good port, but there is nothing to put in it." The jurisdiction of the Shaikh of Kuwait extends nominally for some 200 miles down the western side of the Gulf, when it meets the Hasa territory of Ibn Saud. The shaikhs of Kuwait, who are of the Sabah family, retained a *de facto* independence, notwithstanding the blandishments of their former Turkish neighbours of Hasa and Basra.

The present ruling chief, Shaikh Ahmad al Jabar, C.I.E., enjoys in a high degree the respect of the Arab world, and the confidence of his subjects. His grandfather, Shaikh Mubarak, was perhaps the finest Arab of his generation. "He sat," to quote Lovat Fraser, "in his high chamber, gazing seaward with his inscrutable eyes, with the face of Richelieu and something of Richelieu's ambition yet unquenched within him."

The rule of the Shaikh of Kuwait is personal and absolute. Autocrats, whether in the East or the West, and whether in palaces or parliaments, are as a rule ill informed, for their dependants curry favour by colouring or suppressing unwelcome truths. Though an Arab ruler is generally an autocrat, he is seldom ill informed and, in Kuwait at all events, public opinion has the fullest freedom of expression in the coffee-shop where the Shaikh holds daily court; to him are brought for decision all cases which cannot be amicably settled by agreement; before him any man or woman may state his or her argument without the cost of employing a lawyer, for there are none.

We steam out of Kuwait Bay past the beacon at Ras al Ardh and

past Failaka island, feeling our way gingerly through shoal waters towards the Shatt al Arab. Steaming slowly and guided, as we approach the bar, by the lightship, we anchor near the pilot vessel and wait, along with other vessels, till a pilot comes off. The lightship anchored here is a modern invention and a source of no small pride to those of Basra who are responsible for it; but a thousand years ago lights for the guidance of the mariner existed not only here but at other places along this muddy and shoaly coast, when even in those days the sea traffic from Basra was very great. Masudi in the tenth century tells us, "there are marks of wood erected for the sailors . . . on the side of Ubolla and Abadan, which look like seats in the middle of the water and upon which fires are burnt by night, to caution the vessels which come from Oman, Siraf, and other ports." Idrisi (twelfth century) tells us that such another construction was "situated at the place where the Dijla (Tigris) discharges its waters into the sea of Fars." We turn, however, to Nasir i Khusraw (eleventh century) for the most realistic description of these erections, which were known as *khashab*. He says, "they are erected for a double purpose: firstly, for lighting during the night by means of lights enclosed in glass to protect them from the wind; and secondly, to show the navigator his position. By day a smoke fire was kindled which indicated the position of the landmark from afar. The *khashab* is formed of four great posts of *saj* (teak) wood placed in a square, and having the form of a catapult; the base is broad and the top narrow, and the height above sea-level is forty *guez*.* On the top are placed stones and tiles resting on pieces of wood in such a way as to form a platform on which is a square cabin for a watchman."

I have already attempted to analyze, in the *Journal* of this Society,† the origin of the mudshoals which form the bar of the Shatt al Arab, and the great changes both in the configuration and position of the coast-line since the times when the Euphrates, Tigris, and Karun flowed into the Persian Gulf by separate mouths. Those who wish to have a closer knowledge of the conditions of this intricate approach to Iraq and the great Euphrates-Tigris "corridor," I would refer to the observations I there make.

A pilot from Kharag or Bandar Rig comes aboard our steamer, takes charge with the easy and confident demeanour of pilots all the world over, and we steam across the bar, our course well marked out by lighted and unlighted buoys. Steamers of more than 23-feet draught are unable to cross the bar in either direction without recourse to lighterage, and must remain so until the proposed dredging of a channel, some 300 feet in bottom width, has been accomplished. Two hours later, or thereabout, we pass Fao, the cable station on the right bank of the Shatt where, in November 1914, our troops first landed, capturing

* Twenty-five open hands, placed side by side;

† *Geogr. Journ.*, 65, March 1925.

and dismantling the fort before pushing on to Basra, soaked in rain and half drowned in mud.

The right bank of the Shatt al Arab is a belt of palm trees, stretching almost without a break from Fao to Qurna ; the left, or Persian bank, which is lower by comparison, is less cultivated. Two hours' steaming up the majestic stretches of the Shatt brings us to the great tank farm and jetties of the Anglo-Persian Oil Company at Bawarda and, a few minutes more, to Abadan. Then in less than an hour we reach the spot where the Karun river joins the Shatt on its left bank, with Mohammerah just round the bend. Still a few miles farther up stand two boundary pillars on the left bank, which mark the limit of Persian territory ; thereafter we are in Iraq. Twelve miles more bring us to Basra, the home of Sindbad the Sailor, of "Bassorah dates" and of "Persian barley," and the last resting-place of thousands of gallant soldiers, British and Indian. Here our periplus comes to an end.

A few words in conclusion. In commencing this lecture I said the people of the Persian Gulf were not unworthy of admiration. May I trespass on your patience to say something on the subject to those who, like Sir Alfred C. Lyall, "strive to appreciate the native point of view, and to judge the people and their actions by their own standards, rather than by those of a white man living in their midst," or who, like Sir Hugh Clifford, love "brown humanity" and, having learnt something of the language and religion of an Eastern race, have accepted its social conventions, understanding something of its storied past ?

Religion is an instinct and an aspiration and, even as a social institution of high utility, is not to be easily or safely uprooted, and will long be a mighty force among mankind. But Islam in these waters is rooted, like other religions elsewhere, in the older faiths : many of its shrines on the Persian side were places of pilgrimage before the teaching of Muhammad had replaced that of Zoroaster ; the names of the epic heroes of pre-Islamic days—of Rustam, Zuhrah, and Zal ; of Solomon, Bahram, and Qubad—are still on the lips of men, who have found for them a local habitation, with but little regard to the exigencies of archæology and history. Pictures of these national heroes, and of the saints of the Shiah hagiology, are no less popular to-day than they were a thousand years ago, and the European who would understand Persian or Arab psychology must know something of the stories which may be seen stamped on almost every piece of brass or coloured cloth made on the spot.

The daily life of Persian and Arab alike has in it something of joy and light-heartedness which the acerbities of Islam has not quenched : the Persian prefers the hedonism of Hafiz to the philosophy of Sadi, and the unbending bigotry of the Shiah priesthood is agreeably tempered in the masses by the strain of mysticism which runs through their literature and, amongst the Arab tribesmen, by the sense of freedom which

comes naturally to them from their life in open spaces or amongst the eternal hills.

The dark shadow of a form of bondage akin to slavery falls over many pearl divers ; heat and cold, hunger and thirst, vermin, pain, sickness, and death are to them, as they were to us all in Europe not so very long ago, and to very many during the Great War, a necessary part of life, not things to fear or avoid contact with, but things to face stoically and even light-heartedly, as the common lot of man. Those who have lived for many years in primitive lands among ancient peoples will understand the fascination which the Gulf has exercised over me ; and those who have lived in Islamic countries will understand more easily than others why it is in the East that great religious were born, and why they enjoy, notwithstanding inevitable poverty and much misrule, a cultured stability which Europe has yet to attain.

Our final supremacy in these waters ushered in an era of freedom of trade, of commerce, and good feeling amongst peoples, notably between Arab ports and India, between whom no friendly intercourse previously existed. Amongst these peoples it is our privilege to exercise influence without dominion, to obtain trade without acquiring territory ; successive generations of British officials and merchants have set their mark upon the Gulf without impairing the vigour of the local governments, whose precarious existence we have often assisted to maintain and have never destroyed.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said : You probably all know Sir Arnold Wilson by name. He is going to speak to you about a very interesting and, in many ways, little-known region in which he has spent, I believe, fifteen years—fifteen years in what is, one way or another, the hottest place on the globe. He is going not to speak of particular research in that region, but to give you a general conspectus of the Persian Gulf, which he has perhaps more reason to know well than almost any other living man. He will describe to you its general features. Though Sir Arnold has been fifteen years in that part of the world, not much of that time has been spent upon the actual waters of the Gulf. I believe he held once a consular post in Mohammerah, and you may remember that he was British representative on the Turco-Persian Boundary Commission before the war—a Commission which I believe, as British representative, he came to run entirely, as indeed he has run a good many things since. In fact, he ran it so successfully in the matter of supplies that we can only suppose that by becoming a Director of the Anglo-Persian Oil Company, which he is at this moment, he missed the even more lucrative vocation of becoming a director of Messrs. Lyons! After that he did very great service in the war, and he was, at a time after the war, when Sir Percy Cox became Ambassador at Tehran, our chief Civil Representative in Iraq. In that capacity he had to do many and very difficult things, because he was there at the time of the post-war rising of certain tribes in that country. His name became a household word with every one who had to do with the Eastern theatre of the war, and still more with those who had to do with the difficult problems of that theatre in the first year or two of the peace. I think even those of us who have had some reason to be concerned with the Persian Gulf and

know something about its physical features will have a great deal to learn from the lecturer. I will now ask Sir Arnold Wilson to read his paper.

Sir Arnold Wilson then read the paper printed above, and a discussion followed.

Sir PERCY COX : I have spent the greater part of my lifetime in the sphere which is the subject of Sir Arnold Wilson's lecture to-night, and all the scenes are most familiar to me, so much so that I find it difficult to regard the lecture from a detached point of view ; but he seems to me to have given us a most able and complete historical picture of the Gulf region and of our position there from time immemorial. Nowadays it is apt to be said that the Gulf has lost its importance, and perhaps it is that, as a result of the war, our position there seems so assured that it may have lost some of its interest. When I went to the Gulf in 1899 it was at the beginning of a period of extraordinary interest ; that was before the South African War, before the *entente* with France, and at the moment when Russia was actively seeking to undermine our position there and to get to warm water. All British representatives in the Gulf at that time had a very difficult, interesting, and sometimes exciting task to keep their end up and to maintain our position there. I remember about 1900 the foreign rivalry which prevailed in the matter of sending ships to the Gulf. Admiral Slade, whom I see here to-night, will, I am sure, remember it, for he was Commander-in-Chief of the East India Station there during part of that period, and he knows how keen the competition was. Russia, when sending any large ship to China, would send her for a tour in the Gulf *en route*, perhaps a much bigger vessel than had ever been seen there before, and we had to go one better. Particularly I remember the case of the *Askold* coming up with five funnels, and it was a very difficult problem for us to compete with them. At last, however, one of Her Majesty's ships came up sporting, I think, a sham fifth funnel, and that disposed of the matter for the time !

Then, a little later, I had often a very difficult time with my foreign colleagues and foreign intriguers whose activities were much in evidence during the South African War. One was attacked in every weekly rag that came to the Gulf, and the paragraphs were as personal as they could be. I remember one gentleman saying, "The methods of Major Cox are as crooked as his nose." That always remains in my memory, if it did not stick in my gizzard. After that we had several years of very hard work combating the arms traffic, which furnished the Navy with a difficult task. We spent, I should think, three-quarters of a million on the suppression of the traffic. Now there is practically no such traffic, but at that time arms went in enormous quantities to the North-West Frontier and Afghanistan, emanating mainly from French and Belgian factories and even from our own, because the trade was open by treaty. Thanks however to our vigilant supervision, the traffic is a thing of the past, and is practically non-existent now.

During the war one heard a good deal of the "Mesopotamian adventure" and of the "side-show" that we were running there, but I ask you, now that Mesopotamia is fairly settled, to consider what would have happened if we had not promptly taken up the gauntlet with Turkey, at the head of the Gulf, at the beginning of the war. Things would have taken a very different turn in that sphere, and we should have had endless trouble. We might eventually, having won the war in the West, have recovered part of our position in these waters, but we should have lost all our staunch friends in the meanwhile. I doubt whether we should ever have retained the position we hold now but for

the fact that we had gone at the very beginning of the war to the support of our friends and interests at the head of the Gulf.

In conclusion, I would like to ask the lecturer one or two questions. I always understood that it was accepted that the mounds at Bahrain were built during the lifetime of the occupant, and that he was dropped in at the top when he died. I do not quite see how that could be the case if corpses were brought on pilgrimage from distant countries, as Sir Arnold suggests. Secondly, is there any recent news as to how the dredging of the Fao Bar is progressing? Is it going on actively, and, if so, ships of what sort of draught can now get over it?

Admiral Sir EDMOND SLADE: I am afraid I cannot claim as long acquaintance with the Gulf as either the lecturer or Sir Percy Cox, but I did know the Gulf fairly well during the three years that I was in India. There is one point in regard to which I rather want to traverse what the lecturer said: it is a point which everybody makes, namely, that the Gulf has a beastly climate. I quite agree, but that beastly climate lasts, comparatively speaking, for a short period of the year. The remainder of the year the climate is not at all bad. I have seen snow lying on the low ground at Bushire, and I have seen ice on the borders of the Shatt al Arab; I will admit that I have also seen the thermometer standing, at the same place, somewhere between 120° and 128° in the shade. But there is plenty of choice, and really for six months, or even seven, the climate is quite passable.

There is another point which I would like to bring to your notice, and that is the scenery in the Gulf. You have no idea how fascinating the Persian mountains can look, particularly towards sunset or just after sunset. The colours of the mountains are exquisite. The outline is fantastic, and towards sunset the mountains take on a most glorious rose colour which, as the sun drops towards the horizon, becomes a lovely purple, and then, as the sun disappears, suddenly turns to a deep indigo. I do not know any part of the world in which there are such glorious effects of light, colour, and shade, except perhaps on some of the Greek islands and the coast of Greece.

Then there is another place, Hormuz, which has always interested me extremely in the Gulf. There on an island which is absolutely barren—which is coloured, one might say, with all the colours of the rainbow, for the top of the weird, fantastic mountain or hill which forms the background of the island is deep red; the sides are streaked with red, black, white, and brown; the streams (there are a few) which come down are all edged with white which looks like snow or ice, but is only salt—at the bottom of the narrow strip of land between the sea and the mountain are the remains of what was once a really magnificent town. You can see the streets and walk up them. They are narrow and tortuous, but the houses are clearly marked, and you can imagine what a magnificent city it must have been in years gone by. But how did that city come to be, and how did its inhabitants procure their food and water? There is none on the island; practically nothing grows, except a few scrubby palms. On the mainland about 3 miles away there is water, but it has to be carried across the sea. Eastward there is a rich district which probably, to a great extent, provided the food for the people on the island in the old days. There is also a cultivated district on the islands of Qishm and Larak, but they are a long way away, and communication in those far-off days must have been extremely difficult.

Bandar Abbas, which was the successor of Hormuz, was for a time a very important place. Ships cannot now approach the shore, but in the days to

come, when Persia has her railways and Bandar Abbas will again become a place of great importance, the question will arise as to how the ships can communicate with the shore. Bandar Abbas has more than once, I believe, shifted its site, and there is no reason, as far as I can see, why it should not again do so. If it is moved to a site some 12 miles to the westward of where it is now, it will be possible to build the town on a spot which ships can approach to within half a mile in deep water. The provision of docks and quays would be comparatively easy.

Sir ARNOLD WILSON, in replying, said: I will not attempt to enter into archaeological controversy: we cannot usefully discuss the tumuli at Bahrain until Mr. Mackay's information is available to the public. I hope that it may be published before long. As regards the question of the bar, we are now at 23 feet. The work is undertaken by the Port Directorate of the Iraq Government. We hope to be down to 24 or 25 feet within the next few months. It is a very notable achievement, seeing that the bar was 18 feet two years ago. The work will make an enormous difference to the port of Abadan, and, incidentally, it will enable ships to get in and out of Basra very much deeper laden than before.

As regards the climate, I must plead guilty to Admiral Slade's charge, but I only quoted other people. I have expressed no opinion myself: if I quoted what British seamen under Sir Edmond Slade used to say it would be the reverse of complimentary. It is quite true that for seven months the climate is charming. I have spent nearly eighteen years in the Persian Gulf, and Sir Percy Cox nearly thirty years. We are, if I may say so, living examples of how little harm the climate can do to a European. But the fact remains that it is bad for five months. If you put a fish into water and boil it for only five minutes, it is no consolation to the fish to know it will only be hot for five minutes. We have made enormous strides in the matter of health in the Persian Gulf in the last ten years, not only in regard to ice and electric light and fans, which do not really greatly affect health, in my opinion, though they add to comfort and to enjoyment of life. The health of ships' crews has been improved by the regular supply to men on board ship of fresh vegetables as well as rum and lime juice, and on shore by greater care to sanitary conditions.

As regards scenery, I sincerely agree with every word Admiral Slade has said, but he must remember that he saw those Persian hills from his quarter-deck. I had to see them whilst wandering on my flat feet, and the sight was not always equally inspiring.

The water question at Hormuz is not so puzzling as might be thought. It is perfectly true that there is no water fit to drink there. But Kuwait, which is a prosperous town of some 30,000 or 40,000 souls, gets the whole of its water from Shatt al Arab, 30 miles away, in open boats; yet the place is extraordinarily healthy, presumably owing to the absence of stagnant water. Qais is another case in point. These places depended, as Kuwait does to-day, not merely for water but for everything, upon imports. Another example is Bombay, once a barren island, which now supports a population of a million or so depending on water coming from 50 miles away, and food from anything from 50 to 500 miles.

THE PRESIDENT: Sir Arnold Wilson's lecture has fulfilled the promise which I ventured to make, that it would be an admirable general survey of the Gulf from many and various points of view. Although he did not describe any original research of his own or speak much of research, he indicated that there were certain points in connection with the Gulf, socially and archæo-

logically, upon which considerable research might profitably be done. I do not know in what way Mr. Thomas, whom he mentioned, has dealt with those curious people of the Musandam promontory. I imagine it is by personal visit; and in any case we may wish him all possible success in such research, because there is no more interesting survival than those people. They are almost certainly a part of what is left of the pre-Semitic people of Arabia; like the people of Dhofar and those beyond them on the west. There are three regions, at any rate, in which we seem to have remnants of the people who really began human history in that part of the globe—the pre-Semitic inhabitants. Archaeologically, also, there is no doubt a very great deal to be done. That one dig which was undertaken by the French Susa Mission upon the Persian side of the Gulf has only just tapped a very large field at one point.

As regards Bahrain—I have spoken of it before. I have not much hope that Mr. Mackay's explorations will solve the mystery. It appears to be insoluble. There is extraordinary contrast between the immense size of the mounds and the extreme poverty of any remains inside them. They are not at all like burials in any other part of the world or in any other district of that part of the world; unlike Babylonian, Sumerian, or Assyrian burials. Moreover, the little fragment of an ivory statue which was found there does not seem to me to have anything like the antiquity claimed for it. It is like the work of the very end of the Assyrian kingdom, about the seventh century before Christ. I have not seen the spear-head which Mr. Mackay has found, and I should like to reserve my judgment about its being so old as 1200 B.C. Again, I do not feel at all clear about the probability of Sir Flinders Petrie's theory that transport of corpses from the mainland coast of Arabia to Bahrain supplies an explanation of that large cemetery there. Gerra could not have been a big place; in fact, if the remains near Ajjer are really those of Gerra, they prove that it was, in fact, not a large place nor a place which had much civilization. I should think that it would have been far more likely that the higher civilization, and the really important place of commerce in antiquity, was on the Bahrain islands, and that those tumuli are the cemetery of ancient towns which existed on the Bahrain islands and have now disappeared. However, it is too late to go into archaeological questions in regard to the Gulf. I will only ask you to signify your thanks to Sir Arnold Wilson for his clear and comprehensive picture of a region exceedingly well known by name. Probably we all feel that we know far more of it at this moment than we did about an hour and a half ago!

DECORATIVE ATLASES

Old Decorative Maps and Charts.— Arthur L. Humphreys, F.S.A., with Illustrations from Engravings in the Macpherson Collection and a Catalogue of the Atlases, etc., in the collection, by Henry Stevens. London: Halton & Truscott Smith, Ltd. 1926. 12 × 10, pp. viii. + 51 + xlii. *Seventy-nine Plates, of which nineteen in colour.* 3 guineas net.

THE author of this fine and attractive book takes a collector's pleasure in recording the very great rise in price of the better examples of engraved maps and atlases during the last few years. They are being "sought for and hunted down both for the story of exploration and discovery and for their beauty of ornamentation, their rich colouring, their bits of costume and heraldry, and for the amount of very evident soul which their designers and engravers put

into their execution." In the last three years the value of Speed's Atlas has increased by leaps and bounds, he tells us, and as indeed we had occasion to know only a few months ago, when buying two editions for the Society's collection. But "Speed's maps are rarely found with contemporary colouring. Nearly all Speed's maps now sold are coloured skilfully, it is true, but by present-day colourists." So we may be content that our newly acquired copies were uncoloured.

The nineteen coloured plates are reproduced by the four-colour process, on loaded "art" paper, and with scale a good deal reduced. It looks at first sight as if the colour plates might have been prepared by hand, by a process of stopping out in which most of the engraved black lines had been lost in the decorative parts: but closer examination shows that this effect is due to the heavy opaque colour in which the original engravings have been painted up. Within the limitations of the process and the paper, the reproductions are good: but they have necessarily lost all the character of the originals. If the colour of the original were important, as colour, this would be a grave disadvantage; but we think that it is fair to say that in general the colour put upon these engraved maps by the producers of them was more often a disfigurement than an adornment. The celebrated title-page of Saxton's Atlas, with the engraved portrait of Queen Elizabeth, is a case in point. The uncoloured plate is reproduced by Mr. Sidney Colvin among his masterpieces of English engraving. The colourist, with his thick washes of opaque colour, has ruined the beauty of the copperplate engraving without making anything worth looking at as colour. Apart from a certain superficial attractiveness of the gay heraldry, and the evident practical advantage of having political boundaries brought out by ribbons of colour, there is from the artistic side nothing to be said for painting on copperplate engravings. It seems therefore to be doubly unfortunate that a present fashion for collecting coloured maps should have led to fraudulent damage of much beautiful work.

It appears from the title of the work that all the seventy-nine plates, in colour or in black, are reproduced from the rich collection of Mr. Macpherson. A descriptive catalogue of this collection, by Mr. Henry Stevens, makes a valuable addition to the book; but only the atlases, not the single maps in the collection, are catalogued. It might have been better to call the book "Old Decorative Engraved Atlases," for although they are treated to some slight extent in the text, neither manuscript portolan charts, which are by far the most decorative of all, nor large engraved wall maps, such as the masterpieces of Hondius and Blaeu which adorn the Map Room of the Society, have any place in the reproductions. Every one will agree with the author that "to-day there is room for maps which combine accuracy, symbolism, and colour in a way hardly dreamed of even by the great Dutch cartographers." But we think that success will come, not by adding colour to a black original, but by designing the whole thing in colour from the start, in the style of the famous Catalan map of the Bibliothèque Nationale or the rather less well-known but more beautiful Este World-Map in the library at Modena. Not so sumptuous, but with a more delicate and refined beauty all their own, are the best of the portolan charts at Florence and Venice and Parma. None of these have ever yet been reproduced adequately in colour, and the difficulties are not small; but we have the best of reasons for hoping that they may soon be overcome, and that a small series of the finest will be made available for the delight of the student, or, what is more important still, for the instruction and inspiration of the future cartographer, who has much to unlearn from the present.

In designing a decorative map, colour is perhaps not the principal difficulty. The mapmakers of the best periods, whose work is so abundantly and beautifully illustrated, though on a reduced scale, in the book under review, abandoned the pleasant mediæval habit of drawing fine cities with towers and banners on the land, but filled the sea with ships and mermaids and marine monsters. We have yet to find an artist who can make equally decorative effect with the modern monsters that inhabit the sea, and the sham-antique of some few modern decorative maps is deplorable. There should be something to be done with a decorative treatment of natural features in wall maps where much detail is best avoided, but the map-artist will have to rely most on the wide resources of fine lettering for his effects. In the present collection there is excellent stuff for study in the larger names, though one may regret that there is relatively little fine Roman lettering; a plate or two from the Rome edition of Ptolemy that is in the Macpherson collection would have been valuable. The considerable reduction that the plates have suffered makes them of less use for the smaller characters, which want magnification rather than diminution if their beauty is to be seen and their finer variety appreciated. Some day we may hope to see a collection of full-size collotype reproduction of select bits of lettering, ornament, and conventional signs—even of alphabets reconstructed from the work of the greatest masters, after the style of the patterns which Hondius himself published in his little book on writing.

Within its limits, however—the map engraved on copper and coloured by hand with rather solid paint—the present collection is excellent. It gives a good idea of what the sixteenth and seventeenth century engravers achieved, and of what we may admire in their work; while if we can avoid being carried away by the rather indiscriminating enthusiasm of the author we may even learn what to avoid—the abuse of strapwork, the over-employment of cupids as supporters in heraldry, or the inset of plans and perspectives. A very important part of the decorative map is its frame, and 'tis a pity that some of the plates have been mercilessly trimmed so that the frame is lost.

There are points in the introductory text that seem open to criticism, but we need mention only one. Mr. Humphreys speaks twice of the famous Fra Mauro map as painted on a wall in Venice. So far as one can see it in its deep case of glass in the rather obscure corner of the Biblioteca Marciana to which it has recently been removed from the Ducal Palace, it looks like parchment laid down on wood, with a circular frame to the map proper carved in high relief and gilt, and subsidiary devices in the spandrels outside the circle. Is it possible that the author is confusing the Fra Mauro map with the wall paintings of Giacomo Gastaldi in the Sala dello Scudo, where or close by, if we remember aright, the former was shown until recently?

There is a curious mistake in the title of plate 70, a star map from Van Keulen's atlas of 1709. It is not of the Northern Hemisphere, as stated, but the whole sky plotted on the *plate carrée* projection, peculiarly unsuited to a star map. And it should be noted that the preceding plate, entitled "Star Chart for the Southern Hemisphere," is for the sky south of the Ecliptic, not of the Equator.

A. R. H.

RECENT RUSSIAN ARCHÆOLOGICAL EXPLORATION

DURING the last four years there has been a considerable revival of archæological activity throughout the Soviet Union. The progress of the various expeditions is reported from time to time in *Novi Vostok* (the New East), a periodical publication of the All-Russian Association of Oriental Studies, fifteen volumes of which—some bound together—have appeared to date. Since these explorations have geographical as well as antiquarian interest, and the Russian accounts are not easily accessible to geographers, a brief summary may be useful.

Novi Vostok, Nos. 10-11, gives a brief account of Colonel P. K. Kozlov's expedition to Northern Mongolia under the auspices of the Russian Geographical Society, and this has been supplemented by a publication from the Russian Academy of Sciences—'Kratkie otcheti ekspeditsii po issledovaniyu Severnoi Mongolii v svyazi s Mongolo-Tibetskoi Ekspeditsiei P. K. Kozlova' ('Short Reports on the Expeditions to Northern Mongolia associated with the Mongolo-Tibetan Expedition of P. K. Kozlov'), St. Petersburg, 1925, fifty-eight pages, with photographs and plans. A full account will be published at a later date by the recently founded Russian Academy History of Material Culture.

The Kozlov Expedition * arrived in Urga in November 1923, with the object of carrying out explorations far to the south of that city, but "in view of unforeseen difficulties" the programme was altered, and Colonel Kozlov organized a number of excursions for the exploration of places in the immediate vicinity of Urga. Work was begun in February 1924 on three separate groups of tumuli, 212 in all, situated in three small lateral valleys which intersect the wooded slopes of the Noin-Ulla Mountains, about 80 miles to the north of Urga. The tombs had been looted at some previous date by robbers, but nevertheless rich finds were made of miscellaneous objects in gold, lacquer, bronze, and iron, and, in company with human remains, tissues of silk, felt carpets, and remnants of fur robes and of horse-trappings were recovered. The cultural and historical significance of these finds is reviewed in a report by Mr. G. I. Borovka, included in the publication of the Russian Academy of Sciences. An approximate age of 2000 years is attributed to the culture revealed in the mounds of Noin-Ulla, and Mr. Borovka indicates that it was of a definitely "Scytho-Siberian" character. He regards this "Scytho-Siberian" culture as being intermediate between the Hellenic civilization of the Black Sea region, and the contemporary civilizations of Achæmenian Persia, and of Hân China; and he concludes from the finds at Noin-Ulla that this intermediary "Scytho-Siberian" culture certainly extended over Northern Mongolia. Chinese influence is emphasized in a series of objects which were undoubtedly imported direct from China, such as quantities of silk tissues, with or without embroidered ornaments, and many lacquered objects. Mr. Borovka stresses the importance of the Scytho-Siberian culture, not only as a receptive intermediary between the Hellenic and Iranian civilization and China, but as a creative influence which has affected the development of both European and Far Eastern art.

Novi Vostok, No. 12 (pp. 343-5) gives a short report of excavations made by Prof. V. Smolin in the summer of 1925, in the vicinity of Abashevo, 18 versts from Cheboksari, the capital of the Autonomous Chuvash Soviet Socialist

* A brief note on this expedition was given in the *Geogr. Jour.*, 68 (1926), p. 170.

Republic which lies along both banks of the Volga between Nijni Novgorod and Kazan. Professor Smolin concludes from the finds that "the archaic character of the ceramics, spirals, and of the weighted ear-rings of silver, tin-plate, etc., refer to the epoch of the Second Millennium before our era. The material of the Abashevo tomb appears to be contemporary with the antiquities of the Caucasus, particularly of the Terek Province (village of Faskaï, etc.). The finds at Abashevo open up a wide perspective, and introduce completely new elements into the study of the cultured affinities of the Kama-Volga basin."

In the summer of 1924, G. Bonch-Osmolovski, on behalf of the Ethnographic Section of the Russian Museum, continued explorations already started in 1923 in the mountain districts of the Crimea (*Novi Vostok*, No. 8-9, pp. 391-3). Excavations were undertaken at the cave of Kiik-Koba, near the village of Kipchak, which is in the vicinity of Simferopol. Osmolovski states that "the stratigraphic condition of the find does not leave any doubt as to its Quaternary age." Under the top black stratum appeared a thin brown stratum, under which lay the Quaternary yellow clay. In this mass were found the remains of two hearths, separated from each other by an intervening stratum. The lower hearth was laid out actually on the rocky bottom of the cave. In each of the two "hearth" strata were found the bones of fossilized (*iskopæmiy*) animals, flint shavings, and implements. These are stated to be the remains of mammoth, rhinoceros, deer, antelope, and other animals.

He goes on to state that the flints of the upper and lower strata are to be sharply distinguished, in point of quantity, colour, pattern, and technique of workmanship.

In the "lower hearth" stratum of Kiik-Koba were found the bones of two human skeletons of an adult and of a child. The bones of the adult lay in a hole of rectangular form, which had evidently been excavated in the rocky floor of the cave. The situation of the grave was almost in the middle of the cave, and it was orientated from east to west. The corpse had been laid on its right side, with the knees slightly drawn up.

Osmolovski makes the following preliminary conclusions: (1) In the cave of Kiik-Koba there are two distinct cultural strata, divided by a great interval of time, but genetically related. (2) In cultural chronology the lower stratum must be related to the early Palæolithic; the upper to the end of the early or to the beginning of the Middle. (3) The contemporary relationship of the cultures of the Kiik-Koba cave to the corresponding cultures of the west cannot at present be determined, through lack of knowledge of the sequence of types of fauna in the Crimea. (4) The remains of man, undubitably buried artificially, relate to the period of the lower stratum. Although having points of similarity with the Neanderthal man, they appear to be a little more primitive.

Other Russian archæological activities have covered the Tatar (Kazan) Republic, the Governments of Samara and Saratov and the Caucasus. Important contributions to the knowledge of the history of the Greco-Roman period in South Russia are the excavations of Prof. Farmakovski on the site of Olbia, and of Prof. Borozdin on the site of the Crimean Herakleia (*Novi Vostok*, No. 7). Prof. Borozdin has also carried out excavations at Solkhat and Eski-Yurt in the Crimea (*Ib.*, Nos. 8-9 and 13-14), which, together with Professors Ballod's and Rikov's work in the Volga region (*Ib.*, Nos. 3 and 6) contribute to throw much new light upon the mediæval culture of the Tatar Khanates of Southern and Eastern Russia. In the Caucasus, possibly the most interesting field of all, no serious work has been done. The expedition of

Professors Yakovlev and Baklanov to Daghestan was little more than a reconnaissance, although the discovery of interesting traces of Sassanian influence is recorded (*ib.*, No. 5). Excavations have also been undertaken at Sukhum, in the Abkhazian Republic, on the sites of Byzantine, mediæval Georgian, Genoese, and Turkish ruins. The discovery of bronze instruments at both Mtkhetha and Signakh was reported last summer in the Tiflis Press, and of remains, alleged to be Urartian, in the Qarabagh mountains, but nothing serious has been published with regard to these finds.

In connection with the Kiik-Koba excavations, it is interesting to recall the only find of palæolithic remains made in the Caucasus (with the exception of five elephants' teeth, two of *Elephas antiquus* and three of *Elephas primogenius*, made at different places in Daghestan, Terek, and Abkhazia, and now deposited in the Tiflis Museum). In 1880 at Rgani, now Satcheri on the Kvirila, some manganese workers discovered a cave containing a mass of bones which had been charred by the action of fire. The dispersion of the bones by sale as lucky talismans among the villagers prevented a scientific examination of this find, and it remains doubtful whether human remains were mingled in the *débris* ('Chantre: Recherches anthropologiques dans le Caucase,' vol. I, p. 43).

W. E. D. ALLEN.

REVIEWS

EUROPE

Lost London: being a description of Landmarks which have disappeared pictured by J. Crowther circa 1879-87, and described by E. Beresford Chancellor.— London: Constable & Co. 1926. 10½ × 8, pp. xiii. + 131. *Sixty full-page Illustrations, twenty-four in Colour.* £3 3s.

Original Views of London as it is, by Thomas Shotter Boys, 1842.— With descriptive notes by E. Beresford Chancellor. London: The Architectural Press. 1926. 12½ × 9½, pp. xv. + 111. 30s. net.

THESE two well-produced works are further evidence of the growing interest in "old" London. They are, as it happens, to a large extent complementary—a circumstance probably not fortuitous, though they are separated by a period of nearly half a century. Crowther's drawings, executed in the 'eighties, are of buildings which were then considered in danger of destruction. The drawings were very numerous, though only a selection are reproduced here. It would perhaps be too much to say that this selection hardly deals with London at all, but they are in fact confined to Chelsea, Westminster, Whitehall, the Strand, the Borough, and Vauxhall. It seems likely however that more will be forthcoming, though not definitely promised. In the mean time they are supplemented by Boys' work, which includes most of the great buildings of London irrespective of their probable fate. Both artists, while maintaining topographical accuracy, show appreciation of the pictorial merits of each scene. Boys, in addition, has included something of the contemporary life of the streets.

These volumes will bring some comfort to the student of old London. With the exception of a portion of the Bank and Northumberland House, none of the greater buildings depicted here have totally disappeared. Some have altered to a greater or less extent, and some, as at Hyde Park Corner, have been rearranged; but it is rather their settings that have been transformed. This is brought out especially by Crowther's plates. The chief victims have

been the rambling rows of small shops and dwellinghouses, picturesque, it is true, but surely not always so charming as the artist's brush depicts them. They must now be sought in the small towns and villages on the city's fringe. It is interesting in Crowther's scenes to note how each area presents definite characteristics: we have the almshouses and charity schools of Westminster; the narrow courts and passages between the Strand and the River; the old Inns of Southwark. The last form a particularly interesting group. One could almost wish that Boys too had directed his attention to the byeways. Now that the threats to the City churches and to Waterloo Bridge have been removed, it would seem as if the Londoners of 1975 may have to lament no greater losses.

It would be ungenerous not to mention the fact that Crowther's work was commissioned by the late Sir C. E. H. Chadwyck-Healey, who thus very practically demonstrated his affection for the City. The texts by Mr. Beresford Chancellor display a wide knowledge of topographical detail and much enthusiasm for the subject, but at times tend to diffuseness. G. R. C.

Primitive Culture in Italy.— H. J. Rose, M.A., Professor of Latin, University College of Wales, Aberystwyth. London: Methuen. 1926. 7½ × 5, pp. ix. + 253. 7s. 6d. net.

This is a companion volume to the author's 'Primitive Culture of Greece,' published in 1925, and applies the same methods to answer the question, to what extent any characteristic features of savage life and thought survived into the historic civilization of the Romans and other peoples of ancient Italy? This is not a topic which admits of much geographical commentary, partly because so little is known of early Italy outside the range of Roman influence and information, and consequently so few customs can be assigned a geographical distribution; partly because in many essential respects old Italian culture was continuous from the Apennines to Sicily, however modified in detail, and especially in the material arts, by contact with other cultures overseas. Yet it may be suggested that local variations of custom might be more closely connected with local differences of environment, than is attempted here; there is not, for example, much insistence on the great contrast between highland and lowland peoples, which dominates early Italian history, and sometimes cuts across the contrast between tribes of *p*-using and *q*-using dialects.

Within the strictly ethnographic limits which Professor Rose has set himself, however, there is little to criticize, and much to admire in his concise, lucid, and most readable survey of a subject of which the literature is copious and scattered, and the evidence necessarily gathered from many sources of information. The opening chapters on simple societies generally, and on the relations between race, religion, and material culture in Italy are excellent: the receptivity of the early population is rightly emphasized, in contrast with the bold originality of the Greeks; and the varied sources of foreign influence are estimated with the wide knowledge and scholarly criticism which were conspicuous in Professor Rose's earlier volume. This is a book which, for all its modest appearance, and easy price, will be found a real help to students of ancient history and antiquities. At the end is a convenient list of relevant books; and there is a very serviceable index. J. L. M.

Étude Tectonique et Morphologique de la Provence Cristalline.— Léon Lutaud. (Revue de Géographie Annuelle. Tome Douzième. Année

1924.) Paris: Librairie Delagrave. 1924. 7 × 9, pp. 71 + 15. *Twenty-one Figures, sixteen Plates.*

This volume comprises the results of a regional study of the Geology and Morphology of that part of Provence which is composed chiefly of crystalline rocks. The treatment is full and careful. The author has been critical in the use of his material, and acknowledges amply his debt to previous writers. The volume is illustrated by several good photographs and many maps. Those maps showing tectonic structures are clear, but some of the topographical maps are confused.

The treatment is mainly geological. In his preface the author writes: "Il est vrai que personnellement, je ne reconnais point que la géographie physique soit à proprement parler une science indépendante; telle que je la conçois, elle n'est qu'une branche de la géologie. . . ." Doubtless this will be contested by many geographers, but whatever view is taken, the author, so far as the present work is concerned, has certainly carried his belief into practice.

The volume is divided into two parts: the first dealing with the geology and tectonics, the second with the morphology.

Geologically, the area consists of three "Massifs Cristallophylliens" separated by two synclinal areas in which Permian rocks occur. The north-eastern massif is the Tanneron, the central, Maures, and the south-western, Cap Sicié. This last is, for the most part, below sea-level. It consists largely of a zone overthrust to the north—the *Nappe de Sicié*. The main series of thrusts, which all run more or less east-west, and so oblique to the axis of the region, occur in the Maures, the western part of which is an area of typical imbricate structure. The direction of thrusting is mainly to the north, although examples are found showing a southerly movement. Thrust-structures are absent from the Tanneron—thus supporting the author's contention that the orogenic forces weakened to the north-east. The main movements are all of Pyrenean age: later movements have had much smaller effects.

The present topography of Provence appears to be the outcome of two main cycles of erosion. The first was completed before the Plaisancian (Lower Pliocene); the second is not yet completed. The controlling influence of the Pyrenean movements is still discernible.

The remarks on Raised Beaches are interesting mainly in their bearing on the general question of the formation of the Mediterranean beaches. Remains occur corresponding to the Milaggian, Tyrhennian and Monastirian episodes of Déperet. The author shows that their present distribution in Provence itself indicates a tilting movement, which depressed the south and west and uplifted the north and east parts of the region. Simple Eustatic movements cannot be appealed to in this case.

The volume closes with a chapter entitled "Sur certaines formes du terrain du Cantal attribuées à la deflation," written conjointly by Y. Boisse de Black and P. Marty. It is illustrated by six figures. There are useful bibliographies of literature and maps. Unfortunately there is no index.

J. A. S.

A Wanderer in Rome.—E. V. Lucas. London: Methuen & Co. 1926. 7½ × 5½, pp. xv. + 246. *Sixteen Illustrations in Colour, thirty-six Reproductions from Photographs, and a Picture-map.* 10s. 6d. net.

The latest addition to Mr. Lucas's 'Wanderer' series is less successful than some of its predecessors; the author does not know Rome as he knows

London, and his book frequently betrays his lack of intimacy with his subject. The chief point of this kind of travelling companion is to furnish one with those small but important pieces of information that every intelligent person wants to possess and that Baedeker always forgets to mention: such as the places where you will find the best *filetto alla bolognese*, the most perfect Orvieto. Mr. Lucas, usually sound enough in matters of eating and drinking, seems to have heard of no Roman restaurant but the Ulpia, which—to say the least—is unenterprising. Unhelpful in these small details, he is apt to be unreliable in matters of more consequence. The mistakes, which are unhappily rather frequent, are sometimes caused by hasty inferences (such as that, because *nympha* means a bride, *nymphæum* must mean a “marriage-hall,” whatever that may be; actually it means a conservatory); sometimes they are due to inaccurate recollection (the Capitoline Faun is not a copy of statue by Praxiteles at the Villa d’Este; the Praxitelean original has not survived: the Capitoline figure, a Roman copy, itself came from the Villa d’Este); sometimes they are the result of an uncritical dependence on authority (we are sorry to find that Mr. Lucas has given a new lease of life to that old superstition about the Colosseum having originally been cased in marble; two minutes’ examination of the capitals and mouldings are enough to dispose of the misconception for ever). These may seem small points; but since originality can hardly be expected of one who is bold enough to add to the pile of Roman guide-books, now grown so large that it may fairly be described as the city’s eighth hill, we have at least the right to demand accuracy. Mistakes apart, Mr. Lucas writes with his usual slightly mechanical facility, which is admirably partnered by Mr. Morley’s accomplished if superficial water-colours. R. H.

Rome: Past and Present.— Text by William Gaunt. London: “The Studio.” 1926. 11½ × 8½, pp. xi. + 27. 144 *Plates, of which seven are in Colour.* 10s. 6d. net.

Ever since it occurred to artists, about the end of the fifteenth century, to draw views and prospects for their own sake, and not simply as backgrounds to their figure compositions, Rome has never ceased to exercise a powerful attraction upon the imagination of topographical draughtsmen. The reawakened historical sense of the Renaissance had invested Rome, as the centre of the ancient world it so idolatrously admired, with an immense prestige which was naturally confirmed and augmented by the contemporary power and reputation of the Papacy. In Rome alone could the all-important relics of antiquity be studied and digested, and to Rome came every artist to be educated. At first they used its ruins and monuments as a sort of repertory of classical effects to be introduced as hallmarks of their culture. Later on, about the middle of the seventeenth century, they learned to love Rome for its picturesque qualities; early evidences of this more specifically topographical enthusiasm are to be found in the Velasquez sketches of the Villa Medici and the innumerable views of Rome and the Campagna drawn by Claude and his Italian contemporaries, all of which show the antiquarian interest as subordinate to the love of natural scenery. In the eighteenth century, with the arrival of Pannini and Piranesi, an attempt was made to reconcile the more critical and serious interest in antiquity stimulated by the researches of Winckelmann with the mania for the picturesque and for genre scenes which still possessed the cultivated patrons of art; but the two aims were found to be incompatible. Thenceforth art and archæology parted company, the artist resigning all claims to be considered as an antiquary, and the archæologist austere dispensing with the irrelevant attractions of art.

The plates in the above work, which illustrate these various phases, are on the whole well reproduced and well chosen; the productions of our contemporaries make a poor show beside Claude and Piranesi, Turner and Corot, but serious artists appear to be interested no longer in topographical delineation. The accompanying text is relevant and well informed, if at times a little too lyrical in tone.

R. H.

Peuples et Nations des Balkans.— Jacques Ancel. Paris: Armand Colin. 1926. $6\frac{1}{2} \times 4\frac{1}{2}$, pp. 220. *Maps.* 7 frs. plus 20 per cent. increase.

The "Collection Armand Colin," to which this book belongs, is a series comparable to the "Home University Library" in this country. The book is described by its author in his preface as a study in political geography, and this is again defined as the art of discerning the constant, reciprocal action of the environment on political societies, and of such societies on the environment. The aim of the particular study is to make comprehensible, so far as existing knowledge permits, the apparently inexplicable and incoherent problems of the Near East, by showing that they have a geographical basis. The book has thus to be regarded as an attempt to survey a very wide field of knowledge within a strictly limited framework. The limitations are shown especially in the size—some 200 pages; the impossibility of adequate illustration—there are three outline sketch-maps only; the nature of the references, limited to a brief bibliographical note dealing only with books published in the French language on Balkan topics, general works being excluded. The absence of an index should perhaps not be added to this list, since the omission appears to be quasi-automatic with French publishers. Of the sketch-maps it need only be said that in the two on which towns are marked, these—whether large or small—are shown by circles of the same size, beside each of which stands, with rare exceptions, a single initial letter. There are no references to maps or atlases in the bibliography. The book, according to the publishers' announcement, is within the reach of "toute personne cultivée." It would be a nice test of general education in this country to find how many persons could identify without hesitation all the towns so cryptically indicated.

These notes indicate both the breadth of the author's scheme and the bold policy of compression and omission by which he adapts it to the given conditions. From the general point of view, indeed, the book may be said to raise the whole question of the best method of popularizing knowledge in these days of high publishing costs. Frankly, we doubt whether any one could read M. Ancel's book with great profit unless he had already a fairly wide knowledge of the geography and history of the area discussed. But, on the other hand, the book gains enormously in vividness and grace by the author's assumption that the reader himself should be prepared to do the heavy spade work of preparing the way. It shows that elegance of phrasing, that logical development of a thesis, that broad outlook which we are accustomed to expect from French geographers, and affords a new proof that the French, and so far the French alone, have been wholly successful in making clear to the educated man the fact that geography can give help to those honestly desirous of understanding current problems. It is remarkably impartial throughout, and as against the common view that the Balkan peoples are semi-barbarians, constantly fighting for they know not what, it presents a clear picture of the forces behind the turmoil, and of the trends of social evolution discernible amidst the detailed tragedies of recent years.

M. I. N.

La Grande Roumanie. Sa Structure économique, sociale, financière, politique, et particulièrement ses richesses.— C. G. Rommenhoeller, Consul général de Roumanie. La Haye: Martinus Nijhoff. 1926. 9½ × 6½, pp. viii. + 634. 6.50 florins.

In 1898 Mr. Rommenhoeller published, in French and in Dutch, an economic study of Romania which is of course now completely out of date. His present book is intended mainly for business men, and aims at giving a summary account of the natural wealth of the country and of the developments necessary before its resources can be fully utilized. It opens with a very incomplete sketch of the geography of the country, and there is no map of any kind. But if the geographer will learn nothing from this section, those dealing with the composition of the population, agriculture, agrarian reform, and peasant industries contain much of value to him. In particular there is an interesting discussion of the problem how far the immediate effects of the distribution of the land among the peasants—which have been admittedly unfavourable to production—are likely to be permanent, and the measures which can be adopted to carry the country over the difficult transition period. On the whole, however, the book may be said to be a compilation rather than a reasoned piece of work, and for the geographical reader at least its chief significance lies in the economic facts and statistics which it contains rather than in its argument and method of presentation. There is a good deal of repetition which swells the bulk of the book needlessly, no index is provided, and such references as are given are in footnotes to the pages, and thus not easy to find.

M. I. N.

ASIA

A Year among the Persians.— E. G. Browne. With a Memoir by Sir A. Denison Ross. New edition. Cambridge: University Press. 1926. 10 × 7, pp. xxiv. + 650. *Portrait and Map.* 25s. net.

A new edition of 'A Year Amongst the Persians,' with an excellent memoir by Sir Denison Ross, will afford pleasure to the late Professor Browne's many friends; it will also appeal to a wider circle. It is emphatically a book that can be read more than once, since it reveals Persian character and that at its best. When he visited Persia Browne was young, inexperienced, and had no official position, yet he was treated with extreme kindness and hospitality by Persians of every class, some of whom undoubtedly felt deep affection for him, which feeling he warmly reciprocated. In a sense, his youth and naïve belief in everything he was told made him fit in better with his Persian hosts than an older and more experienced man would have done, and the conversations he so conscientiously entered in his diary undoubtedly constitute the best part of his book. They reveal better than any other work the Persian mind in its dreamy mysticism, which is separated by a deep gulf from the strenuous West. Across this gulf Browne built a bridge, and then sat down permanently on the Persian side of it.

It is curious that the worldly side of his character never developed. His lack of judgment was just as great twenty years later, and, in the difficult and delicate questions of policy that confronted the British Government for many years before the Great War, he could never see any side but the Persian. As a Persian friend expressed it, he was more Iranian than the Iranians. On the other hand, from being steeped in Persian literature, Browne was able to write a monumental work on the subject that is the best in Europe.

His travels in Persia were along main caravan routes, from Tabriz to

Tehran and southwards to Isfahan and Shiraz. Everywhere his descriptions are vivid and culminate in a pæan of praise of Shiraz: "At our very feet, in a grassy, fertile plain girt with purple hills, and half concealed amidst gardens of dark stately cypresses, wherein the rose and the judas-tree in luxuriant abundance struggled with a host of other flowers for the mastery, sweet and beautiful in its garb of spring verdure, lay the home of Persian culture, the mother of Persian genius, the sanctuary of poetry and philosophy, Shiraz."

From this, his spiritual home, he marched to Yezd and Kerman, finally returning to Europe by the capital and Mazanderan.

The present reviewer hardly regards this delightful work as a "great Classic of Travel." For him it will rather remain a charming memorial of a friend, who gave him a copy of the first edition, and wrote in it the Persian couplet:

"On the face of the earth there is no place like Kerman;
Kerman is the heart of the world and we are men of heart."

P. M. S.

East of the Sun and West of the Moon.— Theodore Roosevelt and Kermit Roosevelt. London: Charles Scribner's Sons. 1926. 9 × 6, pp. xii. + 284. *Illustrations.* 16s.

We have here the record of a shooting trip organized on scientific lines in the Pamirs, Turkestan, and the Tian Shan mountains to secure various specimens of big game. The official name of the expedition was the "James Simpson-Roosevelts-Field Museum Expedition," and the members were the Roosevelt brothers and two other Americans. The party left Srinagar on 19 May 1925, and, passing through Leh and over the Karakoram pass, reached Yarkand on July 11. A month later the authors found themselves in the heart of the shooting-ground of the Tian Shan, where record ibex, *Ovis karelini*, and a fine specimen of the Tian Shan wapiti were obtained. The party then set off for the Pamirs, passing through Kashgar, in search of the famous *Ovis poli*. Having secured the necessary heads, they did not waste time, but returned to Srinagar by way of Hunza and Gilgit.

The scientific results of this expedition, when published, will be of much value to zoologists, for there is a study in progress to determine the course of migration of animal-life to the American continent. These results will form the final link, and naturalists should now have all the necessary data. It would also be interesting to study the intergradations of horns from the wide-spreading ones of the *Ovis poli* to the thick, close-curved ones of the *Ovis ammon* types. The photographs taken by Kermit Roosevelt are excellent, and there is also a good index. There are two sketch-maps which enable one to follow the route taken, and at the end of the book is an itinerary giving the daily mileage. A curious system of spelling of place-names runs through the book, and one would like to know why the altitudes, distances, and spelling as adopted by the Survey of India have not been used.

B. K. F.

In Himalayan Tibet.— A. Reeve Heber and Kathleen M. Heber. London: Seeley, Service & Co. 1926. 9 × 6, pp. xvi. + 283. *Illustrations and Map.* 21s. net.

This book is based on the experiences of a twelve years' residence in Ladakh, and in this respect can be compared favourably with many other travel books. The authors are missionaries, and have therefore acquired a first-hand knowledge of the natives in the course of their duties. There are chapters on a variety of subjects, which include a poor historical account of Ladakh, some

descriptions of sports, industries, monasteries, and the mystery play at Hemis. Although the book is full of very interesting facts, yet they are thrown at the reader in a way which makes it impossible to appreciate them. There is not even a good index to act as a guide through this mass of information. The book is illustrated with a large number of photographs which cannot be said to have any very great merit. The spelling of place-names appears to follow no recognized system—an error that could have been easily overcome, as the Survey of India has recently published a revised Route Book which includes Ladakh and might surely be regarded as the standard authority on the spelling. There is a good map by Bartholomew at the end. It is a pity that the authors, with the qualifications they have, did not put their story into a more readable form, as it would then have been a valuable book of reference.

B. K. F.

A History of Assam.— Sir Edward Gait, K.C.S.I., C.I.E. Second Edition, Revised. Calcutta and Simla: Thacker, Spink & Co. 1926. 8 $\frac{1}{4}$ × 5 $\frac{1}{2}$, pp. xiv. + 388. *Map and four Illustrations.* 25s. net.

This is the second edition of what is still the standard work on the subject: it is the only connected history of Assam from early times to the present day that we yet have. Of fresh matter there is but little. The only important epigraphical find during the past twenty years is the copper-plate inscription of Bhaskara Varman discovered in the Sylhet district in 1912. Archæological exploration, hitherto so superficially conducted in Assam, may yet enable us to identify places like Haruppesvara and Hamsakonchi, and elucidate many obscure periods.

Tradition and early history are dealt with succinctly. The chapter on the Koch kings is based upon a vernacular manuscript history of the Darrang rajas. Unfortunately, our knowledge of the earlier history of all the tribes originally speaking Bodo dialects is still very meagre. The special value of the work perhaps lies in the exhaustive and able summary of the history of the Ahom rulers, from their first entry into Upper Assam in 1228 through the vicissitudes of nearly six centuries of domination till their decadence and ultimate subjection by the Burmese about 1819. The original Ahom *buranjis*, or historical records, some of which had been translated for Dr. Wade in 1792–3, had never been critically examined and collated till Sir E. Gait assumed the task, and established the great historical value of these bark-inscribed documents. Useful accounts of the Kacharis, Jaintia kings, Manipur and Sylhet are added, with a description of the establishment and development to date of British rule. A separate chapter has appropriately been devoted to the growth of the Tea Industry.

Until little more than a century ago Assam was practically a *terra ignota* to Europeans. Leaving aside three or four older maps that possibly indicate certain features of, and sites in, Assam, the first map that records readily identifiable names is Lavanha's (*circa* 1550), on which are shown the "kingdoms" of "Comotah" and "Caor." Comotah clearly represents the Kamata of our history, and Caor probably stands for Kamarupa—the Kamru of Al Biruni and Husain Shah's coins, the Kamrud or the *Tabaqat-i-Nasiri*, the Kaonru of the *Ain-i-Akbari*, etc. Ramusio (1554) marks Comotay and Caor as towns; and thereafter during the next two centuries scores of maps show these names in various positions; but with the exception of the addition of a town Azo (*i.e.* Hajo), Assam above Goalpara is unrecognizable till the end of the eighteenth century, when the survey work of Wood, who accompanied Captain Welsh's military expedition of 1792–4, revealed the valley to

just beyond Garhgaon. Even Rennell, on his survey of the Brahmaputra, never got farther than 22 miles above Goalpara (December 1765).

Students of the history of this corner of India find much difficulty in determining with any approach to accuracy the limits of the dominion of the several dynasties that occupy the stage. The boundaries of ancient Kamarupa and mediæval Kamata are still obscure. Much depends on the courses taken by the Mahananda, Karatoya, and Tista from time to time, the determination of which is now difficult, if not impossible. Some writers indicate by means of maps the extent of sway of different empires or races at particular periods. However hypothetical the boundaries thus shown may be, such maps are of undoubted assistance. One of the chief defects of the volume under review is the want of a good map. The story of Assam cannot be properly understood without studying the physical features of the area—especially the great mountain masses that surround it on three sides, and the passes through them—that have exercised an all-important influence on the course of events: yet even the Himalaya mountains are not marked on the map given. An imaginary course is assigned to the Karatoya river, while the now more important river Tista is not shown at all; and Ghoraghat is printed as if representing the *sarkar* of that name in Akbar's time: there has been no such district under our government. More detailed references to authorities utilized, and a good bibliography, would have enhanced the value of this useful work. C. E. A. W. O.

Natural Man. A Record from Borneo.— Dr. Charles Hose, with a Preface by Professor Elliot Smith, F.R.S. London: Macmillan & Co., Ltd. 1926. Pp. xvi. + 286. 127 *Illustrations and a Map showing the distribution of the Tribes.* 30s. net.

There could be nothing but praise for this beautifully produced book did it not suffer from one defect. That defect is one of omission, for Dr. Charles Hose has not made it sufficiently clear that the present volume is largely a recapitulation and abridgment of his former important work, 'The Pagan Tribes of Borneo,' which was written in collaboration with Dr. William McDougall and published in two volumes in 1912. Dr. Hose was over a quarter of a century in the Sarawak Government Service, and is now a member of the Sarawak State Advisory Council. In 'The Pagan Tribes of Borneo' he recorded the fruits of his long and intimate association with the Sarawak natives, dealing with every phase of their cultural and social life, and the result was a monumental work which must remain the standard book on the Sarawak tribes. In that book Dr. Hose gave so fully and generously of his store of knowledge that it is not surprising that he should have little more to add. Yet the first impression a reader will receive on opening 'Natural Man' is that it does contain fresh information. But a careful examination of the two works shows that little of importance has been added, and that the substance of 'Natural Man' has been taken from 'The Pagan Tribes,' rearranged, abridged, and in places rewritten. Such a shortened form of Dr. Hose's previous great work is very welcome, just as the abridged form of 'The Golden Bough' was welcome, but in the interests of students and scientists it should be plainly stated that those who, knowing 'The Pagan Tribes,' go to 'Natural Man' in the expectation of finding fresh valuable information on the natives of Sarawak will be disappointed. Moreover, Dr. Hose has reproduced one or two errors which were inevitable to so vast a work; as when he states that the Muruts do not use axes or blowpipes ('Natural Man,' p. 6, 'Pagan Tribes,' vol. 2, p. 246): whereas all the Murut tribes of North Borneo are adepts in making both.

For the reader unacquainted with Dr. Hose's previous work, however, 'Natural Man' will be a delight. It is a mine of information about the likeable inhabitants of the Sarawak hills and rivers, written lucidly and precisely, so that even those who are not professed anthropologists may derive both pleasure and profit from it. Dr. Hose does well to show that the primitive Sarawak natives are far from being "savages" in the ordinary sense of that word. They are kindly and hospitable, and crime is almost unknown amongst them. As Dr. Elliot Smith well says in his preface, "if his book achieves no other purpose than to establish the fact of fundamental importance that man is by nature peaceful and good-natured, Dr. Hose will have achieved a revolution in anthropological doctrine."

The book is accompanied by a good index. Some of the excellent photographs are reproduced from 'The Pagan Tribes,' but the map showing the distribution of the Sarawak tribes, compiled by the author, is new and is extremely valuable, though "Cape Data," the extreme western coastal point of Sarawak, is a misprint for "Cape Datu." O. R.

AMERICA

Maya and Mexican Art.— T. A. Joyce. London: The Studio. [1926.] 8½ × 6½, pp. 191. *Illustrations and Map.* 10s. 6d. net.

This beautifully produced handbook is one of a series issued under the auspices of *The Studio*, and the first glimpse of its pages offers a refreshing contrast to the familiar outlines of the artistic treasures of the Old World; especially remarkable is the coloured frontispiece, a slightly reduced facsimile of a page in the Zouche Codex, one of the finest of the few surviving Mexican manuscripts.

Mr. Joyce, whose labours in the field of early American archæology are well known, divides his new volume into seven sections, covering certain aspects of the culture of the races who so mysteriously rose to and fell from an amazing flower of civilization; he treats of architecture, sculpture, pottery, painting and draughtsmanship, metal-work, clothing and personal adornment, and stone flaking, mosaic, and feather-work.

The geographical area under survey in this book runs from the Mexican province of Jalisco to the north, to the upper half of the Republic of Honduras to the south; inside this region were built the extraordinary series of stone "cities" whose remains form one of the great wonders of the world to-day, the problem of their rise and ruin being complicated by the glimpses yielded by stone carved inscriptions and figures.

The beautiful photographs illustrating Mr. Joyce's pages show not only the better-known sites such as Palenque, Chichén-Itzá, and Mitla, but the newer site in British Honduras which has recently been under investigation by the British Museum. As regards sculpture, the author says that "the Maya relief sculptor was a master, surpassing in this respect the artists of Egypt and Mesopotamia . . . his delineation of figures in profile was well-nigh perfect"; yet the art was never emotional, being nearly always "characterized by a calm and almost superhuman serenity." The illustrations to the chapter devoted to the sculptor's art bear out Mr. Joyce's claims for New World ability, and form an array of astonishing interest; there is, in this Maya-Aztec culture, a quality invariably arresting, nearly always surprising: for it stands alone, bearing no deep resemblance to the art of any other part of the globe, but stamped with the power of a genuinely original development. Much of the delicate work, the writings and the paintings, of the Maya people have been irretrievably lost, but it is satisfactory to know that to-day every

effort is being made to preserve what remains of stonework, frescoes, pottery, etc., and that Lubaantun, the one great Maya site upon British soil, is being studied and opened by experts.

This carefully prepared volume upon a fascinating subject will prove of great help to students and lovers of art; and the publishers are to be congratulated upon the production of a remarkable contribution to the series.

L. E. E.

AUSTRALASIA AND PACIFIC ISLANDS

The Southern New Hebrides: an Ethnological Record.— C. B. Humphreys.

Cambridge: University Press. 1926. 9 × 6, pp. xvi. + 214. 12s. 6d. *net*.

This is a careful and important account, founded partly on personal experience and partly on the results obtained by previous observers, of the southern islands of the New Hebrides—Tanna, Anaiteum, Futuna, Aniwa, and Eromanga. The book is chiefly valuable to anthropologists, but it is not without some interest to geographers, in that it throws light not easily found elsewhere on just that part of the New Hebridean group which, though nearest to the French administrative headquarters in New Caledonia, is yet least under French influence. If ever again the actual partition of the group between the British and French claimants comes up for consideration, the political geographers will find themselves confronted with a case only to be decided by a new "judgment of Solomon."

The book is provided with an excellent index, but the general reader, and especially the geographers, will regret the absence of a map to show the relative position of the islands lying to the south and to the north of the central island of Efata, where the administrative centre of the Anglo-French New Hebrides Condominium is established.

E. im T.

HUMAN AND HISTORICAL GEOGRAPHY

Studies in English Commerce and Exploration in the reign of Elizabeth.—

A. L. Rowland and E. R. Manhart. University of Pennsylvania Press: 1924. 7½ × 5, pp. xviii. + 190, 179. *Sketch-maps*.

Under this comprehensive title two students of Prof. E. P. Cheyney's have printed their theses presented for the doctoral degree. Though the two studies are bound together in a single volume, they are separately paged and indexed, and are quite independent. The first study, "England and Turkey, the Rise of Diplomatic and Commercial Relations," by A. L. Rowland, treats of the history of the Turkey Company to 1603, with some preliminary survey of early English trade with the Levant. The second, "The English Search for a North-West Passage in the time of Queen Elizabeth," by E. R. Manhart, deals mainly with the voyages of Frobisher, Davis, and Weymouth. Both studies are good examples of the admirable work that is being done in the University of Pennsylvania under the prompting of an inspiring and able teacher, but since the materials on which they are based have apparently been confined to the more accessible printed sources, it would be unreasonable to expect from them much originality of treatment or result. Dr. Rowland's summary of the early story of English relations with Turkey is clear and well written, and may well be consulted as an introduction to the subject. It is to be hoped that he will proceed to a further investigation of the history of the Capitulations, to which he makes brief reference, for there is no doubt that in it there is to be found one of the most important roots of the extra-territorial jurisdiction that has presented so many difficult problems in recent years. Dr. Manhart's study is of less importance, for it adds little or nothing to the well-known story of the voyages to the north-west that is contained in the

Introductions to the volumes of the Hakluyt Society, from which he quotes so frequently. A considerable amount of fresh material in relation to Frobisher has been lately made accessible from unprinted sources, but with this he is apparently unfamiliar.

A. P. N.

A Selection of the Principal Voyages, Traffiques and Discoveries of the English Nation.— Richard Hakluyt, 1552-1616. Set out with many embellishments and a preface by Lawrence Irving. London: William Heinemann, Ltd. 1926. $8\frac{3}{4} \times 6\frac{1}{2}$, pp. xxiv. + 294. *Illustrations*. 10s. 6d. net.

As an introduction to Hakluyt's great work, this attractively produced book should be very successful. Once having read it, few are likely to stop short with Mr. Irving's selection. The narratives, reprinted without alterations, include Hawkins' and Drake's voyages, Cavendish's less fortunate expeditions, and the defeat of the Armada, and these should suffice, in the editor's words, to "swamp the powder with rich jam," or to "rival the most lurid fiction." The preface, written in a hearty swashbuckling style, is a downright defence of the Elizabethan adventurers, and both a challenge and a consolation to modern Englishmen. The reader, however, might well have been left to draw his own conclusions from the texts. The numerous decorative cuts are in the same spirited manner; a few, perhaps, rather overloaded with detail. Some recur twice and even three times. A sketch-map in contemporary style would have completed the volume suitably.

The World Encompassed, and analogous contemporary documents concerning Sir Francis Drake's Circumnavigation of the World, with an appreciation of the achievement by Sir Richard Carnac Temple, Bt. [Edited by N. M. Penzer.] London: The Argonaut Press. 1926. $10\frac{1}{2} \times 8$, pp. lxxvi. and 236. *Maps*. Price 24s.

The aim of the Argonaut Press, of which the handsome volume before us is the first production, is to publish accounts of early voyages and travels, particularly of such as are difficult to obtain otherwise. The general editor, Mr. N. M. Penzer, deserves congratulation both on the extremely attractive appearance of the book, and also on the wise choice he has made for his opening volume. Of all the great English seamen of the sixteenth century no name has a more general appeal than that of Francis Drake, and of Drake's many exploits the most remarkable and the most important in its results was certainly the great voyage round the world begun in 1577 and finished in 1580.

It is precisely one of the early accounts of this memorable voyage that Mr. Penzer has selected for republication: the little book entitled 'The World Encompassed by Sir Francis Drake,' which appeared in London in 1628, and is one of the most important sources of our knowledge of the events of the voyage. The account is based chiefly on the notes of Francis Fletcher, who accompanied Drake as chaplain, but the actual editor was Drake's nephew, another Francis Drake. The original edition of 1628 is now extremely rare, and the work has only been reprinted once in modern times, by the Hakluyt Society in 1854. During the last seventy years, however, much new material has come to light, and there seems ample justification for this fine new edition, in which much of that material is embodied. The book is divided into three main sections. There is first an interesting introductory essay by Sir Richard Temple, entitled "An Appreciation of Drake's Achievement," in which we are taken right through his career from start

to finish, special attention being naturally given to the voyage round the world. This essay is followed by the actual text of the "World Encompassed," printed without notes. The third section is composed of a number of selected contemporary documents connected with Drake's voyage. These include the above-mentioned narrative of Francis Fletcher, the relation of the pilot Nuño da Silva, and Edward Cliff's account of his voyage under Winter in the *Elizabeth*. The first of these is for the first time printed in full from the MS. in the British Museum (portions only having been given in the Hakluyt Society edition and these not always quite correctly), so that here we have a contribution of real value to students of the voyage. Several maps are added to illustrate the course of Drake's wanderings, and a facsimile is given of the rare map by Nicola van Sijpe, which is probably the earliest map known showing Drake's route. It would be difficult to overpraise the general appearance of the volume: print, paper, binding, and format are all alike admirable. The Argonaut Press is to be congratulated on its auspicious start.

F. P. S.

THE MONTHLY RECORD

EUROPE

Distribution of the Welsh Language in Wales.

MR. TREVOR LEWIS, of University College, Aberystwyth, discusses the distribution of Welsh in the Principality according to the census of 1921, in *Annales de Géographie* for 15 September 1926. The persistence of Welsh has been remarkable in view not only of the English conquest but of the constant economic pressure which has forced bi-lingualism on so many young Welsh people of both sexes seeking employment in England or abroad. The strongholds of the language are in remote thinly peopled districts isolated either by the mountains or the sea, whereas the coastal plains have become effectively Anglicized. The five most Welsh counties are Anglesey, Carnarvon, Merioneth, Cardigan, and Carmarthen, in most of which the percentage of Welsh-speaking people is at least 30 to 50, and in smaller areas considerably higher, being as high as 80 to 100 in the Lleyn peninsula of Carnarvon. The southern valleys of the Snowdon massif, the heart of the territories faithful to the former princes, also show a particularly high percentage. The most Welsh area in the southern part of the country is about the long mountain ridge, Mynydd Bach, which trends south-west from Plinlimmon, particularly where Cardigan, Carmarthen, and Pembroke meet. Here the percentage is from 80 to 100. This latter mountain region was a place of refuge for numbers of Welsh Non-conformists during past persecutions, and in general all the highly Welsh areas are strongholds of Welsh Calvinistic Methodism. At the other extreme we have the northern, western, and southern coastal strips where very little Welsh is spoken, always excepting those of Carnarvonshire and Cardiganshire. English influences have spread very rapidly along the north coast, with its numerous seaside resorts and express route to Ireland. In the south of Pembrokeshire, as a result of the influx of English, Norman, and Flemish settlers, no Welsh is spoken at all, and this is nearly true also of the lowland agricultural parts of Glamorganshire. The English border with the valleys of the Severn and Wye speaks comparatively little Welsh, but here we find the curious phenomenon, both in the slate-quarrying districts of the north and the colliery districts in the south, of the Welsh syntax being adapted to the English vocabulary.

Radnorshire is an exception to the usual Welsh-speaking character of the pastoral mountain tracts, an anomaly attributed to military implantations in Cromwell's time. Notwithstanding the national revival of the nineteenth century, Welsh is slowly losing ground everywhere, its resistance to English penetration being weakened by the disruptive tendency noticeable in the various county dialects. The same words are not everywhere used by the country people in the same sense, even though the Bible and religious books preserve some semblance of official Welsh. It is argued that although the Welsh have lacked a central capital for the full expression of their nationalism, the existence of such a centre would have led to a more rapid disappearance of the language on the analogy of the near extinction of Gaelic in Scotland.

Cartography in Estonia.

A brief account of the progress of cartography in Estonia is given by Dr. Haltenberger in a recent publication of the Geographical Institute of the University of Tartu (No. 5, 1925). The basis of the work is the pre-war Russian 1, 2, and 3 verst maps, founded upon the $\frac{1}{2}$ -verst map. Estonia is covered by 421 sheets of the 1-verst map. During the German occupation, survey sheets on the scale of 1/25,000, based upon the 1-verst map, but with some revision and German inscriptions, were prepared. These included the coastal regions, the islands, and the environs of Tartu only. Another map of the whole of Estonia on the scale of 1/100,000 was also issued. Under the present *régime*, the cartography has been taken over by the General Staff. The south-eastern portion of the country, the Petseri region, had not been covered by the Russian 1-verst map. Since 1921, nine sheets on this scale have been published, special attention having been paid to the contours, drawn at intervals of 2 fathoms (about 12½ feet). The publication concludes with a list of thirty-three titles of maps published in Estonia since 1918 by the General Staff and private firms. These include geological, climatic, and other maps of Estonia, and general maps of Eastern Europe and the world. The General Staff have also printed new issues of the 1 and 3 verst topographical maps, and twenty charts on various scales, as well as $\frac{1}{2}$ -verst maps of the Estonia-Russia boundary (twenty-four sheets) and the Estonia-Lithuania boundary (seventy-two sheets), though the $\frac{1}{2}$ -verst and 1-verst maps are not purchasable.

AMERICA

Fisheries of the Great Lakes.

The present position of the fishing industry of the Great Lakes is discussed by Dr. W. Koelz in the Bureau of Fisheries Document No. 1001 (Washington, 1926), recommendations being put forward for its improvement. The history and methods of the fishing and the species of fish are described for each lake separately. Through the number of jurisdictions, international and national, it is difficult to obtain precise information and data, but the production of fish in the lakes has undoubtedly declined greatly since the end of the last century. Some species, particularly the sturgeon, have been practically eliminated from all, and others from individual lakes; for example, the white fish in Lake Superior. In other cases the decline in the production of certain species has been checked: since 1890 the annual catch of white fish in Lake Michigan has increased, but it is still far below its former figure; trout have also increased there, and the catch is greater than those of the other lakes combined. Despite these facts, the total production of Lake Michigan for 1922 was the smallest on record. In Lake Erie, on the other hand, where the conditions for fishing are particularly favourable, the Canadian catch has increased rapidly, the peak year being 1918. Here, however, the increase in catch has not been at all

proportionate to the greater quantity of apparatus used. For Lake Ontario the record catch in American waters was for the year 1880. At the present time the chief species taken appear to be herring and trout. On the whole, the industry seems to be more prosperous in Canadian waters. A census for all the American waters taken in 1917 showed that though the market value of fish had increased 100 per cent., and much more apparatus was employed, the output hardly equalled that of 1908, and was below that of 1890 and 1899. White fish, which was the chief catch in 1880, was fourth in 1922, being rivalled by the sucker, which was previously regarded as worthless. Dr. Koelz, who insists that commercial fishing does not necessarily lead to depletion, attributes the decline to pollution of the water by, amongst other causes, the dumping of ashes from steamers, wasteful methods of fishing, the adoption of unproved systems of propagation, and the diversity of fishery laws. He recommends the constitution of an international authority to promote research and to co-ordinate legislation, the restoration of a closed season to protect spawning fish, and investigations into the life-histories of the important species.

Longitude of La Paz, Bolivia.

A recent publication of the Observatory of the College of San Calixto, La Paz, contains a detailed account of the determination of the longitude of the observatory by Father P. M. Descotes, S.J., and Major A. Prieto. In 1837 and 1852, Pentland, by the transport of chronometers, had arrived at the values of $68^{\circ} 51' 45''$ W. and $68^{\circ} 9' 10''$ W. respectively. The observations upon which the present value is based were carried out in 1922 by the exchange of telegraphic signals with the observatory at Santiago de Chile. The results gave the longitude of La Paz as $68^{\circ} 8' 12''$ 90 W. $\pm 0''$ 1.

POLAR REGIONS

The Greenland Expedition of the University of Michigan.

Prof. W. H. Hobbs contributes a preliminary account of this Expedition to the *Geographical Review* for January 1927. The party of six, under Prof. Hobbs' direction, included Prof. L. M. Gould, a geologist, and Mr. S. P. Fergusson of the U.S. Weather Bureau, as well as a topographer and a wireless operator. The area selected for work was that lying east of Holstensborg, West Greenland, where the strip between the coast and the inland ice is wider than usual. The objects of the expedition were to study the past glaciation, the inland ice, and the meteorological conditions. The district is largely unknown; but Otto Nordenskjöld had made a journey to the edge of the ice-cap in 1909. The party reached Holstensborg on July 6 and left on September 7. Meteorological observations were made at the base camp at the head of Maligiak fiord throughout, while four members of the party, accompanied by Greenlanders, reached the ice-cap by a journey of 75 miles, but were only able to remain there for four days through a shortage of supplies due to the failure of the natives to secure game. Prof. Hobbs concluded that at one time the whole of the district had been covered with ice. A characteristic is the contrast between the higher surfaces of the coastal belt, with convexly rounded contours and ribbed structure, and the lower interior belt, where degradation has proceeded much farther. Here striated boulders, absent from the coast, are common, and the rock surface is well polished and covered with grey glacial clays. The other factor in the checker-board pattern of the topography is the network of fracture lines. He concludes that there was an early advance of ice to the present coast-line, the retreat of which was followed by the formation of cirques on the higher ridges. The ice then readvanced as far as the western arm of Lake Taserssuak,

eroding the interior belt. In the immediate neighbourhood of the ice-cap, the trenched topography becomes more nearly subdued to one plane, with numbers of knot-like hills rising from it, and it is thought that this is similar to the surface now actually overlain by the ice-cap. The existence of twice-eroded cirques is adduced as evidence of this double glaciation. Near Holstensborg, the lower levels of the cirques are at or near sea-level, while farther south they are found at an average elevation of 2000 feet, which points to a post-glacial subsidence to approximately that extent, though raised terraces prove that there have since been repeated uplifts. The features of the meteorological records were the small precipitation (approximately 16 mm. in nine weeks), high average cloudiness, low atmospheric pressure, and slow movement of the wind at all heights. The existence of this warm dry region on the border of the ice is attributed to the ice tongue of the southern Stromfjord forming a barrier to the low-pressure systems from Baffin Bay. *Ballons sondes* were sent up from the base camp, and pilot balloons from the ice-cap. The topographer, Mr. Belknap, triangulated an area of approximately 1000 square miles, prepared some plane-table surveys, and started a line of levels from tide water towards the inland ice. Before leaving, preparations were made for the resumption of the work this year.

The Eskimo Colony at Scoresby Sound, East Greenland.

In April last year (vol. 67, p. 381) we referred to the voyage of Capt. Mikkelsen in 1924 to Scoresby Sound to prepare for the settlement there of a party of Eskimo colonists, and mentioned the fact that this party had been taken thither in the summer of 1925. Captain Mikkelsen has since given a lecture at the Paris Geographical Society on the work of both seasons, and it is printed in *La Géographie*, September-October 1926, so that the narrative is now available in a language more generally understood than the Danish. The idea of forming a settlement on the east coast had a certain political motive behind it, the treaty with Norway having thrown open this coast to the private enterprise of strangers, so that it was important to establish effective occupation on the part of Denmark. Captain Mikkelsen had much to say of the relative richness of the Scoresby Sound region. The abundance of grass justifies the name Greenland, while brushwood covers large areas and many flowers are seen. Animal-life includes walruses, seals, polar bears, musk oxen, etc., some in vast numbers and extraordinarily tame. At Cape Stewart insects were in swarms, including both butterflies and bees, the sound of the latter filling the air. The neighbourhood is strewn with fossil remains of plants and animals of a time when the climate permitted the palm tree to flourish. The voyage home was perilous owing to the loss of the rudder through ice-pressure, but by good fortune was accomplished in safety. Seven men were left to continue the preparations for housing the settlers, and were cut off from the outside world until the visit of Dr. Charcot in the *Pourquoi pas?* on 1 August 1925. One of the seven, the geologist Petersen, had died, but the rest were well. During an enforced stay at Cape Stewart owing to bad weather they were kept amused by the tameness of the foxes, which are there in great numbers and entered the houses without fear. An interesting discovery was that of hot springs at Cape Tobin, which maintained a temperature of 62° C. throughout the winter. Early in September Captain Mikkelsen returned with ninety Eskimo colonists of all ages, brought from Angmagsalik, who greeted their new home with enthusiasm and at once set about their ordinary avocations. The result of the experiment will be awaited with interest.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Dutch Pendulum Observations in the Great Oceans.

Considerable interest has been aroused in the voyage of the Dutch Submarine K XIII., which left Helder on 27 May 1926, with Dr. Vener Meinesz on board, for the purpose of making determinations of gravity at sea by means of a new apparatus. The preliminary results of the voyage, down to the arrival at Honolulu, have been communicated to *Nature* (29 December 1926) by Dr. J. J. A. Muller. Owing to rough weather it was unfortunately impossible to take observations above the slope to the deep sea, but from June 2 onwards the pendulum apparatus was used nearly every day while at sea from the submerged vessel, and it fully answered to expectations. The deep-sea soundings were not so successful, the senders of the under-water clock signals having been placed too high in the ship, in the wave zone, so that the echo was not a definite sound. Owing to a defect in the construction, which could not be remedied on board, the sonic depth-finder proved of no use, so that the additions to our knowledge of the depths of the oceans along the route are less than had been hoped. Still some results of interest were obtained. In the Atlantic, between 32° and 54° W., rapid changes of depth were noted, and the sea-bed appears to be very rugged: the depths showed great differences from those indicated on the Prince of Monaco's charts. Dr. Muller gives the preliminary results of computations of anomalies of gravity on the several sections of the route, which led by Curaçao and the Panama Canal to the Pacific, then by Mazatlan to San Francisco, Honolulu, and Guam. A cablegram reported the arrival at Amboina on November 25. Both in the Atlantic and Pacific the excesses of gravity extend over enormous areas, while the excesses or defects on the continents possess a more limited, regional, character. The preliminary results show no trace of ellipticity of the Equator, but for a solution of this problem the final results must be awaited. Dr. Meinesz was to stay in Java for some time to recover from the fatigues of the voyage before returning home in a mail steamer. He had met with great help from the commander, officers, and crew in carrying out this task, and at all the ports touched at he received a cordial reception, especially from scientists at San Francisco and Honolulu. As a token of appreciation the United States Coast and Geodetic Survey undertook to compute the isostatic reductions of the observations, and they have already been received for those between Holland and Curaçao. The excess of gravity in the Atlantic has thereby been confirmed.

GENERAL

A Pair of Globes of 1522.

In speaking a few years ago of the various old globes preserved at Vienna, Dr. Eugen Oberhummer mentioned a pair in the Hauslab-Liechtenstein collection, on the history of which, by careful examination, he had been able to throw some new light. He has since dealt more fully with these globes, in conjunction with Herr A. Feuerstein, in a communication printed in the *Denkschriften* of the Vienna Academy of Sciences (67 Band, 3 Abhandl., 1926), and accompanied by photographic illustrations. The terrestrial globe had previously attracted attention as giving one of the quite early representations of America, and had been described by Varnhagen in 1872, and subsequently discussed by Wieser, Luksch, and others. Its general resemblance to Schöner's globes of 1515 and 1520 had led some of these writers to attribute it to that German map-maker, while it was even suggested that it was earlier than 1515 (the American portion showing a clear relationship with Waldseemüller's map in the Strasbourg Ptolemy of 1513), and that it might have been copied

by Schöner. The celestial globe, which strangely enough had previously been entirely ignored, though the two are evidently a pair, has supplied the clue to the making of the globes, as it bears an inscription (now with difficulty legible) stating that it had been made to the order of Nicolaus Leopold, "Canonicus Brixinensis," as a gift to Sebastian Sprenger (chosen Bishop of Brixen in 1521) in the year 1522. It seems probable that Von Hauslab acquired the globes at Brixen while engaged in mapping the Tirol in 1816-17, and their association with the place had suggested itself to earlier students through the prominence given to it on the terrestrial globe. The latter is undated, but it is probably slightly later than its fellow. There is an evident allusion to Magellan's voyage in the picture of a Spanish caravel off the coast of Chile; and the results of this voyage did not become generally known till 1523. Another indication of a date at least after 1520 is the reference to the "Guiaicum lignum" as a product of the island of Haiti, a statement almost certainly taken from Apianus' map of 1520, which in turn had taken it from the work of Ulrich von Hutten printed at Maintz in 1519. In the main, however, the terrestrial globe is a close copy (so far as the size permitted) of Waldseemüller's big map of 1507, the wording of many legends being almost, or quite, identical. But that Apianus' map too was known to the maker is proved not only by the reference to the Guiaicum, but by another statement found in the globe, which is made by Apianus but not by Waldseemüller. The relationship between the Brixen globe and Schöner's can now be fully explained by the use of a common source, namely Waldseemüller's big map, which is more closely followed by the former than by any of the other maps of the time. The illustrations accompanying the paper give general views of the two globes with reproductions of certain parts of the world-picture and of the signature of the celestial globe.

The Cork Industry.

The present position of the cork industry is briefly touched upon by Dr. W. O. Blanchard in the *Journal of Geography* for October 1926. The cork oak forest areas are mainly confined to Iberia and Northern Africa. Algeria, Portugal, Spain, and Morocco have the greatest acreage; but the order of production of cork is otherwise. Portugal and Spain are shown as producing 35 per cent. each of the world's total, but Portugal's share is probably the greater, as it exports considerable quantities to Spain. Algeria is credited with 20 per cent. of the total. War demands greatly stimulated the industry, but since then the decline of the Russian and German markets, the introduction of prohibition in the United States, and the invention of substitutes for bottle-corks have hit the industry in Catalonia. Other markets have been closed by protective measures. As Great Britain, France, Germany, and the United States take about 85 per cent. of the world's output, an alteration in their demands is serious for the industry. Cold-storage insulation and packing for fresh fruit, however, utilize a considerable proportion.

OBITUARY

Sir John Scott Keltie.

JOHN SCOTT KELTIE was born at Dundee on 29 March 1840 and died in London on 12 January 1927, within three months of completing his eighty-seventh year, preserving almost to the last day the remarkable vigour of body and mind which characterized his whole life.

He was educated in Perth, then successively at the Universities of St.

Andrews and Edinburgh, and at the Theological Hall of the United Presbyterian Church in Edinburgh, where he completed the course but did not enter on a clerical career. While a student he had begun systematic literary work with Messrs. W. & R. Chambers, and after ten years in Edinburgh, where he married, he in 1871 came to London to join the editorial staff of Messrs. Macmillan & Co. There he became sub-editor of *Nature* in 1873, and editor of the *Statesman's Year Book* in 1880. Geographical subjects had early attracted his attention, and in 1873 he began to contribute geographical articles and reviews to *The Times*, and gradually acquired a position of authority on matters of travel and exploration.

Keltie, who had joined the Royal Geographical Society in 1883, was in 1884 appointed the Society's Inspector of Geographical Education, the selection being made from a number of candidates. After a strenuous year spent in examining the whole question of geographical education in the British Isles and on the continent of Europe, he produced the memorable Report which occupies more than 150 pages of vol. 1 of the *Supplementary Papers* of the R.G.S. This Report is an important landmark in the history of geographical studies in this country, and may well be viewed as the starting-point of the rapid progress which has brought Geography to the front as an indispensable branch of University studies. Before the completion of the Report the Librarianship of the Society fell vacant by the tragic death from small-pox of Mr. E. C. Rye in February 1885, and Keltie was appointed to the post in the following month, when Lord Aberdare was President and Mr. Markham (afterwards Sir Clements Markham) and Mr. Douglas Freshfield Honorary Secretaries. An exhibition of books, maps, and educational apparatus collected by the Inspector of Education was arranged in the Map Room of the Society in Savile Row, and afterwards shown in different parts of the country; it was ultimately presented to the Teachers' Guild.

The duties of Librarian at that time were light and only occupied a small part of the day, leaving ample leisure for the pursuit of literary or journalistic work, of which Keltie took full advantage. By degrees he was drawn into closer and closer cooperation with the Assistant-Secretary, Mr. H. W. Bates, F.R.S., until he became his right-hand man in all that concerned the working of the Society, so that on Bates's death in the influenza epidemic of February 1892 Keltie was accepted at once as his natural successor. Thenceforward the routine of the Society filled an increasing share of Keltie's time, and he modified his literary work so as to make it ancillary to what had now become the great purpose of his life, the promotion of the interests of the Royal Geographical Society.

The first important task that fell to him was the reorganization of the Society's serial publications. The New Series of monthly *Proceedings* which took the place of the old irregularly published *Proceedings* in 1879, had under Mr. Bates's editorship gradually come to assume many of the features of a magazine, collecting information from other sources than those which reached it by the channel of the Society's meetings. It was felt by the more progressive members of Council that the revival in interest in geography which was reflected in the rapid growth of our membership demanded the presentation of geographical intelligence in a form more popular than that which had hitherto been considered consistent with the dignity of a learned Society. The battle raged mainly with regard to the conspicuous retention as the chief title on the cover of the word "Proceedings." On this point a temporary compromise was effected, but it was not till fourteen years later that the title was simplified by the adoption of the more generally attractive and less

cumbrous form now in use. The first number of the *Geographical Journal* appeared in January 1893, and its success under Keltie's judicious and skilful direction was both immediate and permanent. A similar problem was presented by the evening meetings, at which the more conservative authorities were at first opposed to the use of lantern slides until the almost surreptitious introduction of a singularly beautiful set overcame all prejudices. In this, as in the fiercely contested matter of the admission of ladies as Fellows of the Society, Keltie was on the side of progress, though he preserved a semblance of official impartiality with no little effort. As a mark of the appreciation of his services in this time of transition the title of Assistant-Secretary was replaced by that of Secretary in 1896, thus restoring the practice which prevailed before 1849.

In 1895 the Society was responsible for the Sixth International Geographical Congress, the planning and management of which taxed Keltie's powers to the uttermost, but the resulting success justified the efforts which he made to secure it.

The conduct of the routine of a rapidly growing institution of such large and varied interest as the Royal Geographical Society would have been work enough if it had been possible to continue to expand in its existing premises, but for many years the Secretary's time was invaded by the additional labour of first searching for and then getting settled into new premises. This was achieved in 1912, when the Society moved from 1, Savile Row to Lowther Lodge. Although Keltie was now seventy-two years of age his vigour was unimpaired, and few could have guessed from his appearance that he had passed his sixtieth year. He recognized clearly enough that he could not hope to carry on his heavy work indefinitely, and he welcomed the appointment of Mr. A. R. Hinks, F.R.S., as Assistant-Secretary, realizing the importance of initiating his successor before he himself had to retire. In 1915 he handed over the Secretaryship to Mr. Hinks, continuing to act as joint Editor of the *Geographical Journal* until 1917, when, still in the glow of popularity with Council, Staff, and all the Fellowship of the Society, he felt it expedient to retire. His *Reminiscences*, communicated to an evening meeting of the Society on 5 February 1917, were published in the *Journal*, and give a panoramic view of the activities of the Society for the thirty-five eventful years during which he had been at the heart of affairs. He was destined to share in the government of the Society for ten years more as a Member of Council and later as Vice-President, and during this period, despite his years, he never missed a meeting of Council or committee which it was possible for him to attend.

While he himself would undoubtedly agree that his labours for the Society were his chief contribution to Geography—and it was no small one—he did much to promote sound views on doubtful problems, especially those of colonial expansion, by the frequent unsigned contributions to the Press in which he helped to mould public opinion. He was the initiator in collaboration with others of several important series of geographical works of high value, such as the *World's Explorers Series* published by Messrs. George Philip & Sons, and the *Story of Exploration Series* published by Mr. Alston Rivers. His more direct contributions to geographical literature include 'The Partition of Africa,' an account of discovery and colonization in the years which followed the journeys of Livingstone and Stanley, and 'Applied Geography,' a small textbook expounding great principles. At the time of his death he was completing a series of school readers in collaboration with Mr. S. C. Gilmour.

Keltie was an unfailing attendant for forty years at the annual meetings of

the British Association; for a long time he was Secretary of Section E (Geography); at the Toronto meeting of 1897 he was president of the Section; and later a member of the Council of the Association.

Following on the International Congress of 1895, Keltie was elected an Honorary Member of the Vienna Geographical Society and Honorary Corresponding Member of practically every Geographical Society in Europe and of several in America. Later he received the Cullum Medal of the American Geographical Society of New York, the gold medals of the Paris Geographical Society and of the Royal Scottish Geographical Society, and in 1917 the Victoria Medal of the Royal Geographical Society. His *Alma Mater* at St. Andrews conferred on him the honorary degree of LL.D., and he was decorated with the orders of the North Star of Sweden, St. Olaf of Norway, and White Rose of Finland. In 1918 he received the honour of knighthood.

The leading characteristics of Sir John Keltie on which his success depended were quick intuition, great caution, and kindly tact. His intuition served him well by enabling him to get at the heart of a subject in an incredibly short time, and his caution helped him to avoid the pitfalls which usually lie in wait for an abnormally active brain. Whether in reviewing books or appraising the potentialities of a would-be explorer, the balance of these two qualities gave great value to his judgments. Latterly caution naturally tended to preponderate, and "When in doubt do nothing" became a favourite quotation; but he was very rarely in doubt. His tact in overcoming difficulties of prejudice and temperament was unfailing, and in the days of keen international rivalry in exploration this did much to preserve a harmonious atmosphere in the Society. Keltie's nature was both kindly and generous, and his official relations with explorers rarely failed to ripen into friendship as lasting as life. When the Society's headquarters were still at 1, Savile Row, a day seldom passed without a geographical lunch party in one of the adjacent restaurants or in his Club, with Keltie as the bond of union—not infrequently between notorious rivals. His Sunday evening parties, when his genial duties as host were shared by his daughter and son-in-law, live in the minds of many survivors now scattered over distant lands, and were cherished memories with more who went before him. Not least will he be missed in the scientific and literary dining clubs which he loved to frequent, and especially in the Geographical Club, the centenary of which he had hoped to celebrate this year, the "Sette of Odde Volumes," and the "Confrères," of which he was the last surviving original member. In social intercourse he had in a high degree the gift of promoting conversation, though he himself spoke little; and rarely allowed his own views on controversial matters to appear. Few except his most intimate friends could have known his opinion on political, literary, or religious matters, for his tolerance was unbounded. He was too busy a man up to the very end to have time for sport or any form of relaxation except an occasional round of golf, and the meeting with friends at the dinners of Clubs and Societies, a pleasure that he was able to enjoy to within a few weeks of his death.

To those with whom he worked Keltie always showed himself as a considerate colleague rather than as a chief, and he had the rare knack of guiding by imperceptible influence. He was faithful to the friends of his youth, and was particularly thoughtful in showing kindness to those whose lives had been less fortunate than his own. I met him first in 1885; since then our friendship has grown ever closer, and I write under constraint, lest warm affection should lead me beyond the limits appropriate to an appreciation of the life-work of a geographer.

HUGH ROBERT MILL.

An adequate reason has been brought to my notice why I should respond to the request that has been made to me to add something to Dr. Mill's tribute to the cherished memory of our old friend and excellent colleague, Sir John Scott Keltie. I am, it appears, the only living member of the Council that in 1885 added Keltie to the permanent Staff of the Society. At that date I had already served for four years as the Junior Honorary Secretary. One of the more prominent subjects of our discussion at that period was what steps, if any, should be taken by the Society to support and stimulate Geographical Education in this country. Mr. Francis Galton's scheme—one of offering school prizes—had broken down; a single school (Dulwich College), happy in a zealous instructor, having year after year swept the field. The Council was for the moment divided: to one section it appeared that Education was beyond the scope of the Society, and that it should limit its efforts to the promotion of Exploration and Research, while Mr. Galton—habitually in Committee more critical than constructive—was ever at hand ready to point out ingenious objections to schemes that were substitutes for his own, which had admittedly failed. It was a counsel of prudence on the part of the Educationalists, who included the Hon. Secretaries, to postpone discussion until they had had time to strengthen their case by obtaining evidence of what was being done on the Continent and particularly in Germany. Some one had the happy thought of commissioning Keltie, already known to us as a very competent geographer, to go the round of Europe and to investigate and report on the state of Geographical Education in the various countries.

Dr. Mill has pointed out, and I need not repeat, how well Keltie carried out his mission. His report was the chief weapon in the Hon. Secretaries' hands, and it proved an effectual weapon. Opposition melted before it. After due discussion I was authorized by the Council to appear before the Vice-Chancellor of Oxford, then Dr. Jowett, and in the name of the Geographical Society invite the University to accept our aid in providing funds for a School of Geography. A similar offer was made to and accepted by Cambridge.

It is therefore to Keltie in the first place that we owe that Geography now holds in this country a place in Education at least equal to that which it does on the Continent. The policy of beginning at the top, with the old Universities, has fully justified itself, and the Schools of Oxford and Cambridge have sent out teachers, both men and women, who have raised the standard of teaching throughout the country and provided us with textbooks that are no longer open to reproach.

On another matter I was at the time intimately connected with I am glad of an opportunity to confirm and emphasize what Dr. Mill writes. I refer to the development of the *Geographical Journal*. Markham as an Hon. Secretary had for years struggled in vain to persuade the Council to issue a monthly periodical in place of occasional and unattractive *Proceedings*. When leave was, in 1879, at last granted it was given with many hesitations and restrictions; it was not till fourteen years later that these were one by one removed or forgotten, and a happy result was mainly due to the quiet tact and literary judgment of Keltie, to whom it was reserved in 1893 to give the cover a simpler and more suitable form.

In Council Keltie—in this resembling Bates, his predecessor in the Secretaryship—seldom spoke. He was in public equipped with a persuasive and impressive reticence, but in the informal conferences held between the President and officers of the Society that commonly preceded Council Meetings we always listened respectfully to, and often profited by, his sage and well-considered suggestions. Keltie's natural kindliness was an invaluable quality in carrying

out the daily work of the Secretary, which consists largely of interviewing many various conditions of men, in attaching to the Society the right sort of traveller, and in eliciting from each visitor what of importance he may have to tell. Few callers, I fancy, left Keltie's room discontented. His tact and courtesy were irresistible. Even the globe-trotter who came to him with a few unimportant notes or photographs was apt to leave under the impression he had communicated to the Society invaluable information.

Keltie's retirement from office was regretted by all the Council, most of all perhaps by those of us who as Honorary Secretaries had shared for a period his labours. The act was, I think, not least of all a trial to himself. To resign at the call of age the work of a lifetime is no doubt the part of a wise man. But the better the work has been performed the greater must be the wrench: and Keltie was always younger than his years. We all rejoiced, therefore, that it was possible to soften the severance of old ties by keeping him among us, first as a Member of Council and finally as a Vice-President. It was a further pleasure to his many friends among our Fellows that Keltie's services to Science and the Nation, carried out mainly as an officer of the Society, should have been recognized by the State. No man ever less sought for honours than Keltie, yet honours came to him from all quarters, and gave him the satisfaction of feeling that his lifelong exertions had been fully recognized in almost every country in Europe. In the future the Society may possibly have secretaries who will be more prominent as travellers or scientists, but it will never have a better geographer or an official more devoted to its service and its highest interests.

DOUGLAS FRESHFIELD.

At the Evening Meeting of January 24 the President invited the Fellows present to associate themselves with the terms of the following Resolution, which the Council had adopted that afternoon:

RESOLVED that this Council place on record their high appreciation of the devoted services to geography which Sir John Scott Keltie rendered during his thirty years' tenure of office in the Society as Inspector of Education, Librarian, and Secretary and Editor of the *Geographical Journal*, as well as since his retirement from office as a Member of the Council and Vice-President of the Society: and they ask the President to convey to his daughter, Mrs. Lennox Gilmour, the assurance of the Council's sympathy with her in her loss and their sorrow at the death of a well-loved colleague.

We have the writer's permission to publish the following letter from Dr. Fridtjof Nansen:

"The sad news of the death of my very dear friend Sir John Scott Keltie has only now reached me. May I ask you to accept and to convey to the Council of the Royal Geographical Society the expression of my deepest sympathy in the great loss for your Society, for Geographical Science, for us all? You will know better than I could explain it what he has been during his long working day for the Royal Geographical Society and for Geographical Science, but I do know perhaps better than many of your members what he has been for geographical travellers. During the thirty-nine years I knew him I have experienced how he always encouraged and assisted in every possible way any geographical enterprise which he thought good and worthy of support, and with what unreserved appreciation and enthusiasm he greeted any deed of exploration which brought new light. And what a staunch friend he was

to the young explorers! I cannot say why, but ever since the first day we met in May 1888, when I was on my way through London to the crossing of Greenland, we have been friends for life. I cannot possibly say how much I owe to him. I always had his implicit confidence in my plans and undertakings, however much they may have been attacked by others, and his encouragement, advice, and untiring support were always a wonderful stimulus and help. And so I know it was with other travellers. His influence upon what has been done of geographical work during his years is difficult to measure, but it was important. He was a man in whom there was no deceit, a true son of Scotland, a noble man, and a true friend.

From the many other letters addressed to the Society we may extract this excellent phrase of Dr. Isaiah Bowman: "He was to a high degree an Institution in himself." To all those who have written the President and Council have expressed their cordial appreciation.

CORRESPONDENCE

The Mishmi Country

I WAS much interested in Mr. D'Arcy Weatherbe's brief account of his and Mr. Stevenson's journey from Burma to Assam *via* the Krongjong Pass, which I have just read in the *Geographical Journal* for July. May I, however, correct a wrong impression which the reader can hardly avoid?

Mr. Weatherbe says: "... but we had no trouble whatever with the Mishmis, and found them quite a manly and certainly a reasonably friendly and hospitable people, *previous and contrary reports notwithstanding*" (italics mine).

I think that if Mr. Weatherbe had travelled in the Lohit Valley, say in 1906 (or even considerably later than that) instead of in 1926, he himself would have made a "contrary report."

It is unnecessary to go into all the attempts to blaze a trail through the Mishmi Hills, either from Sadiya to Rima or in the reverse direction, until we come to the period 1911-1914, with Major F. M. Bailey's journey from Batang *via* Rima to Sadiya in the former year, and Mr. T. P. M. O'Callaghan's journey from Sadiya to Rima in the latter year.

Major Bailey, most resourceful of travellers, had great difficulty in getting through the Mishmi Hills below Rima in 1911.

Then followed the Political and Survey Missions of 1912-1914 up the Lohit Valley, and in 1914 the present Political Officer of the Sadiya Frontier Tract, and other officers, travelled up as far as Rima, being everywhere welcomed by the people.

It is due, first to the unremitting labours of a succession of Political Officers at Sadiya, particularly to the late Mr. Needham and to Mr. Dundas; secondly to the missions of 1912-1914, and to the administration of the present Political Officer, who has won the entire confidence of the frontier tribes, that the Digaru Mishmis are now a "reasonably friendly and hospitable people." A period of contact with frontier and other British officers has sufficed to bring to the surface, through a natural veneer of suspicion, the underlying human qualities which exist in most of these tribes, however much they may be masked by circumstances.

I think Mr. Weatherbe is incorrect in saying that "the old Mishmi path which was supposed to exist up this river had become entirely obliterated."

It suggests that the path is no longer used. The path is used regularly in the winter months by Mishmis who cross the Krongjong to fish in the headwaters of the Mali Kha (Nam Yiu); occasionally they wander as far south as Fort Hertz. The difficulties encountered by Mr. Weatherbe were due mainly to the season and to an unusually wet spring in Hkamti Long; for the path on the Burma side follows the river-bed practically from the head of the Hkamti plain to the pass itself, and in the latter half of April, with the snow melting at those comparatively low altitudes (the Krongjong being under 10,000 feet), the river-bed would of course be pretty full.

Mr. Weatherbe's statement that "the Zayul Chu has not so very much more water in it than the Ghalum" is astonishing to any one who has seen both.

The Zayul Chu (Krawnaon) flows almost due south from Rima to Minzong, where it turns abruptly at right angles, receiving the quite small Ghalum from the east; and though it is true that from the Tidding (not Tiding) to Sadiya is nearly 100 miles by road, the distance in an air line is under 50 miles.

Mr. Weatherbe's journey is of considerable interest to those who study the North-East Frontier of India; he is quite right in claiming to be the first European to cross the Krongjong, though his route was known to Wilcox a century ago, and is mentioned by Griffith, and has of course been accurately mapped by Indian surveyors. But it is desirable that the account should be minutely accurate, so I hope he will forgive these few comments.

F. KINGDON WARD.

Sadiya, Assam, 12 December 1926.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

Sixth Evening Meeting, 24 January 1927.—The President in the Chair.

ELECTIONS.—George Edward Bearn; Herbert Edwin Bradley; John Dorr Bradley; Mrs. Mary Hastings Bradley; V. Edward Charawanamuttu, PH.B., A.C.P., F.C.I., M.A.A.S.; Major William Henry Saxon Davies, O.B.E.; Lieut. Edward Walter Fletcher, R.A.; Mrs. Elizabeth Fuller Goodspeed; Archibald Ernest Alfred Gostling; John Leggat; Miss Sylvia Sarah Linton; Miss Elsie Dorothea I. Murray; Capt. W. J. Norman; Fred Bury Osborne, M.A.; Brig.-Gen. Ernest Moncreiff Paul, C.B., C.B.E.; John R. Rymill; Robert R. Rymill; James Salter; Gwilym Emlyn Thomas, M.A.; Benjamin Walker, A.R.I.B.A.; Albert Whiteside.

PAPER: The Shaksgam Expedition. Major K. Mason.

Seventh Evening Meeting, 7 February 1927.—The President in the Chair.

ELECTIONS.—Hubert Stewart Banner, B.A.; Arthur Barrett, J.P.; Miss Louie M. Brooks; Charles E. Glogau; Masauji Hachisuka; Harry Fitzgerald Harlock; Dr. Lee S. Huizenga; David Morgan Jenkins; Capt. Gerald Lowry; William McClymont; Percy W. May; Sir John Robert O'Connell, LL.D., M.A.; Percy White Stevens; Mrs. Diana D. Tahourdin; Alexander A. Thomson, B.Sc., A.R.S.M.

PAPER: The Didinga Mountains. Mr. J. H. Driberg.

Fourth Afternoon Meeting, 14 February 1927.—Sir Percy Cox, Vice-President, in the Chair.

PAPER: The Landfall of Columbus. Lieut.-Commr. R. T. Gould.

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THE SHAKSGAM VALLEY AND AGHIL RANGE

Major Kenneth Mason, M.C., R.E., Survey of India

Read at the Meeting of the Society, 24 January 1927. Map follows page 384.

I SHALL commence to-night by two quotations from a native report, written some fifty years ago. The first is :

"A road from Askardu across the Mastagh Mountain joins at Ak Masjid the road from Kokyar, thus : Shagar, Kashmal, Baha, Baldaldu, Ististi, Dawan Mastagh, Jangal, Dawasu, Shakhs Kambo, the Khaltan Darya flowing on to Khargalik, Ak Kuram, Ak Masjid, Kokyar." *

The second runs :

"Another stream called the Yarma or Nobra flows from above the Changlung, which was anciently traversed by a route to Khapulung. This route was closed by the people of Nobra, who, by throwing in of charcoal, helped the formation of iceblocks, which obstructed the passage altogether."

Neither of these descriptions is quite correct, but both contain some elements of truth. The first has the earliest mention of the place "Shakhs Kambo," or Shaxsgam, that I have been able to find, and gives very vaguely the alignment of the route taken by Sir Francis Younghusband in 1887 ; the second introduces more vaguely still an ancient route, about which I shall have more to say presently.

A few days after I was born, in mid-September 1887, Lieutenant Younghusband, as he then was, stood on the Aghil pass, after having crossed the greater part of Asia. He looked southwards, across a broad valley, at one of the most wonderful panoramas of ice that it is conceivable to imagine. He descended into this unexplored valley—the Shaxsgam—and crossed the great Karakoram mountain wall of ice by the difficult Muztagh pass, to India.

Almost exactly two years afterwards Captain Younghusband again stood on the Aghil pass. On this occasion he explored the Shaxsgam

* Probably : Shigar, Askole, Biaho, Baltoro, Ordokas, Muztagh pass, Suget Jangal, — (?), Shaxsgam, the Yarkand river, Ak-kuram, Ak Masjid, Kokyar.

more thoroughly. Before going down it to search for the Shingshal pass he ascended it from the foot of the Aghil pass, passed the snout of the Gasherbrum glacier, discovered the Urdok glacier and explored this to its head, below a col over which his guide informed him there had once been a route to India.

The details were published in his report and in his book 'The Heart of a Continent.' With his permission, I will now quote from his journal for 13 September 1889. He records that the Shaxgam valley continues beyond the Urdok glacier "level and open with a direction 150° , while about 15 miles beyond, another valley branches off to the east with a direction of 120° , and the latter must probably run very nearly up to the Karakoram pass."

Sir Francis was in an intensely glaciated region, and possibly because it is very difficult to judge distances in that country this description that I have quoted was never published in his account, and as a result map-makers have rather naturally assumed that when he turned up the Urdok glacier he was in the neighbourhood of the Shaxgam source. This assumption was the beginning of much subsequent trouble.

It must be remembered that the map in those days showed tributaries to the left bank of the Yarkand river flowing all the way from the Karakoram range, and that the watershed of the latter was not shown correctly till Dr. Longstaff's exploration of the Siachen glacier in 1909. The faulty alignment of the range led mapmakers to stretch the Shaxgam valley too far south, and also led Sir Francis to doubt the correctness of his identification of a great peak which he saw from Durbin Jangal, a spot 12,300 feet above sea-level in the Shaxgam valley. This misidentification was suggested to him by the Duke of the Abruzzi, and his longitudes, which were dependent on it, were still in doubt up to this year. I may say at once that a comparison of the sketch made by Sir Francis from Durbin Jangal with my photographs from the Tatar La, leaves no doubt that the great peak he saw was the "Staircase Peak" of the Duke of the Abruzzi.

Since 1889 no European, and most probably no human being, had been in that part of the Shaxgam which Sir Francis discovered and explored. Nor did any of my party actually set foot upon his route. In my description of our expedition, I shall show how we came from the east; how we explored down the valley, which must be the one up which Sir Francis looked; how we were held up and forced over the mountains to the north; and how we were prevented from regaining the Shaxgam lower down. The head basin of the Shaxgam, its sources and upper tributaries, and its first big feeder glacier have now been discovered, explored, and surveyed; photographs beyond have been taken down the valley, and a planetable map, which will be improved by those photographs, has been made; a large portion of the Aghil range has been reconnoitred and surveyed; and a very large

tributary to the Shaksgam river, whose existence was unsuspected, has been discovered. But there is still a gap of about 6 miles between two surveyed ridges, within which the middle Shaksgam must lie, and Sir Francis remains the only white man who has been here, though the position of his river is now very closely determined in longitude as well as in latitude.

Sir Filippo De Filippi in 1914 intended to explore the Shaksgam, but he was prevented from doing so by the amount of water in the Yarkand river. Colonel Wood, however, who was attached by the Survey of India to the expedition, from near the head of the Yarkand river, discovered an easy pass—Pass “G”—leading to a broad open valley unencumbered by glaciers—Valley “H”—which he thought afterwards must be the source of the Shaksgam, though at the time he did not know of the paragraph I have quoted from the journal above. Sir Filippo De Filippi suggested that Valley “H” might break northwards and join the Yarkand river.

After the war De Filippi and Wood planned more than one expedition to clear up the situation, but for one reason or another—mostly political and financial—the projects fell through. I was made spiritual heir to the Shaksgam in 1923, and after two years of negotiation my plans were finally sanctioned by the Government of India in November 1925. During those two years I received an immense amount of help and encouragement, particularly from the present Surveyor-General of India, Colonel Commandant E. A. Tandy, from Mr. R. Ewbank of the Government of India, from Colonel Wood, from General Sir Alexander Cobbe and Mr. Monteath of the India Office, and from the Council of the Royal Geographical Society. Without the moral support and very material assistance which you gave me the expedition would not have come off. As soon as sanction was given, I again received the greatest assistance from every one, including the various departments of the Government of India, and most especially from Mr. Hinks, who pushed out to us from England all our private supplies and much of our equipment.

The expedition was directed by my own department, the Survey of India, at Dehra Dun. The other members of my party were Major Minchinton, M.C., of the 1st Gurkhas; Major Clifford, D.S.O., M.C., Indian Medical Service; Captain Cave, M.C., the Rifle Brigade; Khan Sahib Afraz Gul Khan, Survey of India; one Pathan orderly from the Survey; and three Gurkha sepoys. We took three cooks for this party, but no other servants.

The main object of the expedition was to survey the unexplored mountains and valleys west of pass “G,” especially the following:

- (1) Valley “H.”
- (2) The sources and course of the Shaksgam.
- (3) The northern glaciers of the Karakoram range.

(4) The Aghil range and mountains north of the Shaksgam.

We were also to explore for traces of any human occupation or passage, ancient or modern, in this area. Subsidiary points requiring investigation cropped up during the preliminary arrangements, and were undertaken. Some of these do not closely concern geography, but I must mention that Clifford and I took up field geology, Cave the collection of birds and meteorological study, while Minchinton and Clifford decided to collect butterflies and plants respectively. The various results are now being worked out by experts.

On the Pamirs in 1913, I had used the pioneer apparatus for stereographic survey devised by the late Captain Vivian Thompson, R.E. about 1904, and I was anxious to try in 1926 the latest developments by this method, which in the meanwhile had been much improved. After exhaustive inquiries, the Council of the Royal Geographical Society resolved to purchase for my use the photo-theodolite made by Mr. Henry Wild of Heerbrugg, Switzerland. The material which I have brought back will be worked up during the coming year, but you will be able to judge the fine definition of his camera from many of the slides which I shall put on the screen to-night. I had with me also a Zeiss theodolite, whose design is also, I believe, due to Mr. Wild, and the usual planetable equipment for the Khan Sahib.

Following the advice of Colonel Wood, we decided to attempt the exploration during the months of July, August, and September. We expected difficulties with summer floods, but hoped these would not be insuperable; the great advantage of summer was the possible use of animal transport, for at that time of year, from the experience of the De Filippi expedition in the Yarkand river-basin, we could hope for a fair amount of grass, while in winter there would be none, the *burisa* fuel would be covered with snow, and the depth of soft snow on the passes would render pack transport out of the question. As it turned out, owing to the difficulties of the country and the unexpected lack of grass, our permanent animals were practically useless, and a larger complement of porters would have been far more valuable.

The winter of 1925-26 was unusually mild in Northern India, but just as we were beginning to give thanks, the spring produced a still more unusual series of late storms, which deposited a large quantity of snow on the Himalaya, blocking the passes. Weather reports wired to us from Simla, however, indicated a fine break, and during this we crossed the Zoji La by candlelight on the night of May 15. Two days later some natives, trying to cross the pass in the early morning, were swept away by an avalanche and killed.

We reached Leh without difficulty on May 27. Our purchase of supplies and ponies was already well advanced, thanks to Major Hinde, the British Joint Commissioner, and to Khan Bahadur Ghulam Mahomed, his representative at Leh. But owing to the late season, and a minor



1. Looking down the Upper Shaksam from above the Depot. Lungpa Marpo opening on right
From Station W₃

[All photographs by Major Mason with the Wild Photo-theodolite

23,720

23,770



2. Apsarasas Group, Karakoram Range, and Head of the Kyagar Glacier from the north
From Station IV₇

official's obstruction, we had some trouble with the Khardong pass. Our first attempt to cross it on the morning of June 7 was a failure, for the yaks—there were about sixty of them—stuck in the soft snow, shed their loads, and the owners then drove them off to their own valleys, saying the pass would not be passable for twenty days. However, after much persuasion, we collected thirty fresh animals and made a second attempt to reach the pass, on the morning of the 10th. We reached the summit with nine unladen yaks while the snow was still hard, and after improving the pass with coolies, drove the yaks down again on the Leh side in the soft snow. Yet even now it was not easy to persuade the naib-tahsildar of Leh to give us the necessary transport, though the men themselves were willing to come. At last, at 2 a.m. on June 13, we started once more for the pass with our whole caravan—21 unladen ponies, 24 permanent Ladakhi porters, 100 yaks, and about 100 coolies to assist. By midday we had about half the kit on the summit, together with all the coolies and half the animals. The rest of the baggage was strewn over the snow, and many of the animals, including ten of our ponies, had been sent back. All members of the party, including the cooks, worked throughout the morning with great energy; at one place we had five animals almost buried in 6 feet of soft drift snow, and we only defeated this difficulty by laying canvas tent bags down on the snow, putting poles under the animals' bellies, and heaving them up with a dozen men. We were not fully concentrated at the first village on the north side until May 15, nine days after our first departure from Leh.

At Panamik, in the Nubra valley, we had to halt for two days, in order to draw the greater part of the fodder and to make final arrangements for our caravan. Panamik is the last village in Ladakh, and we could expect no more supplies until we returned here in October; we also engaged four men for our postal arrangements. Two of these were accustomed to ford the Nubra and two were from the Shyok valley; by working in pairs to a pre-arranged programme they kept us in touch with human habitations.

The Wazir of Ladakh had sent my proposals ahead, and the caravan was more or less ready. I considered however that his suggested terms were not quite fair to the pony-men, and therefore gave them the same rates they would get for normal caravan traffic, plus a little extra on condition they obeyed all my orders implicitly. At this early time of the year they obviously feared the Saser pass, and this fear, much more than the pass itself, was nearly the cause of their undoing. We arrived at Skyangpo-chhe,* on the near side of the Saser pass, on June 22, with about 180 laden ponies, 10 unladen yaks, and 24 porters. The next morning Minchinton and I went forward with porters, pony-men, and unladen yaks to clear a track on to the glaciers, which descend from the hills on both sides of the pass. While so engaged the men suddenly

* See Note on Names at the end of the paper.

gave a shout, and we saw descending one of the glaciers, a man leading a pony, followed by two more men. A trader and his followers, overcome by snow-blindness and exhaustion, had abandoned their merchandise and ponies and were descending the pass. Minchinton cut a track up to the stranded animals, while I revived the trader, and by evening we were able to send the caravan down to Skyangpo-chhe. The man, Torabaz Khan, took the trouble to look me up after our return from the expedition, and we found that he received all his merchandise which we sent back to him, and all his ponies survived. He told us that our dates had been forwarded from Leh to Yarkand, and that he had expected to find the pass opened by us.

The next day, June 24, we crossed the Saser pass and reached Saser Brangsa. Although we had already made a track for most of the way, we had to man-handle all the animals over two bad stretches, and before we reached the final glacier the whole caravan went on strike. A lucky snowstorm came to our assistance, and as we disappeared over the pass with our own men and animals, we saw the hired caravan reload and follow us.

After this incident we had no further trouble. We left behind us a granite land and entered one of limestone. The Depsang was unpleasant, but, from the accounts of others, not so unpleasant as it can be. We passed a night at the spot where De Filippi had his depôt, and leaving the Karakoram pass on our right hand, reached the Amphitheatre near the head of the Yarkand river, discovered by Wood in 1914, on June 29. Here we had a day's rest, for the animals were very exhausted, having had practically no grass for five days. I am not going to describe the litter of bones that point the way to Central Asia; considering the time of year, we were perhaps lucky in not increasing this litter more than we did. We were now off the caravan route, and Wood's party was our only predecessor.

On July 2 we crossed Pass "G," and entered the unknown. Wood says of the valley beyond in his report:

"The valley was fairly open but of no great width, and was bounded on both sides by high hills, only snow-covered on their summits, and no glacier of any sort could be seen to enter it."

The following morning we continued down this valley "H." It is bounded on the north by rounded disintegrating hills, off which the snow had only recently cleared. The glacier astride the pass was only yielding a small amount of water in the early morning, but this increased during the day, and the water in the stream was augmented by the melting of small hanging glaciers of the "clotted cream" variety, perched between lofty mountains. Not more than 6 miles from the pass the stream entered a gorge—our first surprise of many. This presented no difficulty, but later in the year a way would have to be found over the

top of it. It was of limestone, split in every direction by frost. Some 14 miles from the pass we halted the caravan, and formed a *dépôt* half a mile from the junction of our valley with a large valley flowing from east to west. Before going any further, I must mention that though I have spent much of my life among high mountains, and have done six seasons' survey work in the Himalaya and beyond, I have never seen a country the topography of which is so difficult to appreciate from a distance; until we actually reached the junction mentioned above, we could not say for certain which way the new valley led.

On July 4, two days after the date I had laid down a year before in Simla, we paid off the hired caravan and gave them their rewards. There had been no casualties or sickness among the men, but of our own twenty-one ponies three had died, and there were in addition sixteen deaths among the hired ponies and yaks.

The next morning, leaving the Khan Sahib to climb a ridge near the *dépôt* to get a theodolite resection, and giving our animals a rest, we explored down the valley. Stream "H" enters the main valley through a narrow cleft of rock, about 10 yards long and 10 feet wide. The junction beyond is a broad stony amphitheatre, varying from 300 to 600 yards wide. The combined streams take a direction a little north of west, and flow in a large number of channels. A mile and a half below the junction, a level line becomes noticeable on the slopes on each side of the valley. Starting at the level of the flood plain, it gradually mounts the hillside, as the valley floor sinks. After another small gorge, the valley again widens out, more parallel lines become visible on the slopes, and at a distance of 4 miles from the junction a large valley enters from the south, and forms an amphitheatre more than half a mile wide. This tributary valley leads from a glacier, which was afterwards surveyed and found to descend from a saddle at the head of the Rimo glacier. The combined valleys change direction to a little more north of west, and a most wonderful sight meets the eye.

The hills on either side slope up at an angle of 30°, framing the broad flood plain. Beyond, and at a distance of some 2 miles or more, can be seen the blue waters of a considerable lake, and at the far end of this stretched a glacier, a mass of huge seracs and contorted ice, athwart the whole breadth of the valley. Beyond this again the higher slopes of the valley could be seen continuing, and far away—most wonderful of all—the giant summit of Gasherbrum, wreathed in cloud, stood sentinel.

We hurried on to the edge of the lake, passing first great blocks of ice, and then mud flats. We had with us two canvas collapsible boats, and after launching these we made our way round to the glacier snout, a distance of about $2\frac{1}{4}$ miles, in the hope of finding a way past the obstacle below the northern cliffs. We found only a chaotic mass of floating icefloes, and the snout of the glacier, white ice and black ice, tossed against

the red marble cliffs to a height of 300 feet. Minchinton climbed on to the snout, but found the surface too much torn asunder to proceed beyond the edge.

We recognized at once that this glacier was going to be a very serious obstacle, and one which would take some days to circumvent ; so, after returning to the dépôt, it was decided that the Khan Sahib and I should commence the survey, while Minchinton and Cave should reconnoitre for some way across the glacier. Meanwhile Clifford was to reconnoitre up the valley.

Our Ladakhi porters had named the lake the "Kyagar Thso,"* and the glacier naturally became the Kyagar glacier. Minchinton and Cave went off to explore it on July 6, and returned on the 9th. They had, after a preliminary reconnaissance from their camp, crossed a shale col over the mountains bordering the Kyagar glacier on the east side, and got on to the glacier some 4 miles from its snout, at about 9 a.m. Several times they attempted to cross it, but were always forced back by high seracs, deep crevasses, or glacier lakes. Some of the ice pinnacles were 200 feet high, and the whole surface was so cut up that they were eventually forced back on to the lateral moraine on the east. Following this up, they found that it led to a promontory descending from the main range.

Minchinton's opinion was—and Minchinton is a fine climber, who has had experience of mountaineering since he was fifteen years of age—that a difficult way could be found across the glacier, after a good deal of "trial and error," for lightly laden porters ; that at least one camp, and probably two, would have to be placed on the glacier ; that no amount of labour would make a route practicable for animals ; and that, if possible, it would be better to attempt a turning movement to the north. He was more impressed with this notion after receiving a note from me, giving my views after his first reconnaissance, and from the fact that a second glacier, which he believed would also block the valley, could be seen stretched across the valley lower down.

Having started the triangulation, based on resection from uncaired points of Wood and Alessio, and leaving the Khan Sahib to carry on the detail survey, I took a camp to the lake, and with Cave made four stations for the photo-theodolite on the mountains east of the glacier. From these we had a very fine view down the main valley and across the Kyagar glacier. The latter takes its rise from the northern wall of the Karakoram range, which here attains an altitude of 23,000 feet, directly under the "Apsarasas group" of the Workmans, which fall very steeply to the glacier head, in a series of broken icefalls and bergschrunds. The head was divided by two long promontory spurs into three head feeder glaciers, that from the east being subdivided into three subsidiary heads, that on the west swinging round from the northern face of Teram

* See Note on Names at the end of the paper.

Kangri, which from this side shows a great rounded snow-cap, seamed with bergschrunds, and impossible to climb.

At the foot of the ridge we were on flowed, rolled, jumped, and tossed the chaotic stream of the glacier. For 5 or 6 miles from its snout it is an amazing jumble of ice pinnacles, rising to 200 feet in height. Occasional pools of clear sapphire-coloured water, and rare patches of longitudinal gravel moraine lay almost hidden among the seracs, but the whole surface presented an icy chaos, and every "lead" that I examined ended in impassability. The snout was hard pressed against and had cut into the marble wall across the valley, and occasionally great masses of ice would break from it and fall into the Kyagar lake. Beyond the snout of the glacier the valley opened out once more. Then a second glacier, probably from Teram Kangri, thrusts forward its snout, though I personally do not think the valley is entirely blocked by it. Beyond this the valley again opens out—I will not guess the range, but the Wild photographs will give its distance—and the surface of another glacier across the valley, but not its snout, could be seen. This possibly is the Urdok glacier of Sir Francis, but the Wild photographs must again decide this point.

Now I come to the sight that riveted our attention and made it hard to record the rest. The wonder of all rose at the far end of the valley—four great giants, clothed in ice. Gasherbrum I., 26,470 feet, the "Hidden Peak" of Sir Martin Conway; Gasherbrum II., 26,360 feet; the "Broad Peak," whose height was fixed by the Duke of the Abruzzi at 27,130 feet; and lastly, the perfect cone of the second highest mountain of our Earth, K₂, 28,250 feet. Even the Ladakhi porters stared in silent wonder. It was a sight quite beyond my power to describe.

I saw the four great mountains first by sunset, and on my last visit by sunrise. I was forced to halt by the way to watch the changing colours. From a steely grey against a dark night sky, the "Hidden Peak" was revealed in all the shades of grey through gold to crimson. It was almost a sin to have to take scientific observations to such a mountain.

Owing to bad weather, I had to climb these stations four times before I could get the photographs with the Wild camera. But every visit was worth the effort, and in spite of the high wind—several times I had to pack up the Wild instrument, and once my plane-table was blown bodily off the hill—it was always difficult to wrench one's eyes from the end of the valley.

The several visits, however, showed us a gap in the wall of red marble that enclosed the valley on the north, and through this gap there streamed a flood of sunlight in the early morning. This gave us the hope that a *détour* over the "Red Wall" might give access to this gap and lead us back to the Shaxsgam below the block. In any case, as we were so

dependent on pony-transport, it did not seem worth while to force the glacier with a small party; for after many days we should only have traversed the country which we could well see from our stations, and the rest of our party would have been rendered immobile with useless pony transport. We all were, and still are, absolutely convinced—I cannot put it stronger—that this valley is the same that Sir Francis Youngusband saw from the Urdok glacier snout, a description of which view I have already quoted from his journal.

While we were engaged on the work that I have described above Minchinton and Clifford were looking for ways over the mountains to the north. Colonel Wood had marked on his map, which I had with me, certain red crosses at the end of tributary streams of his "I" valley. These crosses indicated the points where he thought an entry could be effected to the valley, if necessity arose. But he was only in "I" valley for two or three days, and the side stream which gives most promise of a route when seen from that side, was found to be blocked by a glacier low down on the Shaksgam side. The small tributary entering the Kyagar Thso from the north was also found to be very confined, and led to a gorge and glacier, whose ugly snout blocked the way. Both these routes were reconnoitred and discarded. Almost opposite the junction of Valley "H," however, a narrow tributary came in from the north-west, called afterwards the "Lungpa Marpo," descending from a group of peaks over 21,000 feet high. This had seemed to me from one of my stations to offer the most practicable route, and reconnaissance by Minchinton and Clifford proved this to be the case.

It was now July 17; we had crossed Pass "G" a fortnight before. I had made several triangulation stations, and the Khan Sahib had practically completed the survey by planetable of all the ground within view. All the branch tributaries had been examined. The river was beginning to rise considerably, and the lake had extended 500 yards and increased some 15 feet in depth. The amount of grass had not come up to our expectations, and though the ponies were on very light work they were in very sore straits. A fourth had died, and two others were very thin and weak. The weather, though fine on the whole, had given us two samples of what it could do if it liked. After fully considering all aspects, and after full agreement between us all, we decided to transfer our dépôt gradually to the head of Wood's valley "I," partly by porters by the Lungpa Marpo and Marpo La, and partly by the fittest of the ponies, which would go round by Pass "G," Wood's Amphitheatre, and the Yarkand valley. When reassembled in the head of "I" valley, we would cross the head, reported by Wood to be similar to Pass "G," and therefore, as we then hoped, presenting no difficulty, attempt to force a way back to the Shaksgam by "the gap in the Red Wall," and failing this, strike the alignment of "the ancient route between Nubra and Khapulung." Though things turned out very differently from what we then

expected, we are still convinced that we pursued the right course. We feel sure that, had we tried to descend the Shaksgam, or even sent a small party down it, the amount of water would have prevented any useful work, and possibly might have led to disaster. At the very best the party must have been cut off from its dumps, and would have arrived in Hunza in a very desperate condition ; and the remainder would have spent their time in fruitless search parties.

On July 20, leaving supplies at the *dépôt* to be collected for the return journey, Minchinton and I left with the porters for the Lungpa Marpo, and Clifford and Cave started back with the ponies with light loads for the Yarkand river. Our route led up the steep ravine, which contained a glacier with a more or less dead end. This glacier lay in a north-west to south-east direction, and had a total length of some 7 miles, of which the upper four were level and led to a col, which Minchinton had already reconnoitred and pronounced impracticable for laden porters. But at the point where the level *névé* began, a second branch glacier was thrown over the watershed, forming, as it were, the on-side saddle-flap to the glacier saddle on the watershed, and this drained into the head of " I " valley. Our route led up the right side of the glacier—the off-side saddle-flap—past some rather treacherous overhanging seracs, and along the right moraine, as far as the level portion. We camped near the top of the pass on the night of the 22nd. Our tents were pitched on the glacier, which was thinly covered with moraine, at about 18,000 feet.

The following day was a long one. The pass itself was easy, and after concentrating our porters on the far side and sending them down to " I " valley, Minchinton, the Khan Sahib and I, keeping to the 18,000-foot contour, explored the other head of " I " valley. Wood in 1914 did not explore this northern head himself, and his report is from hearsay. From no fault of his, it is somewhat misleading, for it is incomplete. There are two large glaciers, not one, which send down long streams of broken ice to the watershed. We climbed on to the first glacier at about 18,200 feet by a lateral moraine, and crossing to its centre, discovered the second. We could see that they joined some distance below us, and that the combined snouts were hard pressed against the hillside opposite ; but we saw enough to give us hope that we should be able to cross both of them high up if necessary. There was still about three feet of winter snow on the glacier, and we had to feel for crevasses. This glacier takes its rise from a very grand group of red marble peaks, clotted with ice, rising to 22,000 feet. The valley draining the second glacier could not be properly seen, and we were unable to determine which way it lay ; we hoped that it would pierce the " Red Wall."

We still had time to examine the snout of the first glacier. Wood writes, from what he was told : " Like the glacier at the source of the other branch " (*i.e.* that on the Marpo La), " this too sends tongues into the valleys on either side of the pass. This latter is quite practicable

for animals, as the glacier blocks neither it nor the valley, but rests on the southern slopes, leaving an easy passage. It is very similar to the Pass 'G' near the Remo snout of the Yarkand river."

A close view of the snout and the hills unfortunately proved that this was altogether too rosy a view. From the stream below the glacier we looked up at a snout of towering seracs, at the north side of which was a narrow passage over fallen blocks of ice. The ice at the extreme end was perched on a rocky outcrop, which had been cut through by the glacier stream. We made our way up this defile, which was quite impracticable for animals, under tottering ice pinnacles, for about 100 yards, and then the ravine came to an end. We were faced by a wall of rock 60 or 70 feet high, over which the stream poured in a waterfall. Climbing the hillside to the north of this fall, we came to two small cairns, which must have been built by Wood's men, and showed us that they must have taken a higher level. We therefore kept now to this level, crossed a shale spur, and were brought to a halt by a considerable lake filling a gap between the glacier snout and a bay in the hills. After reconnoitring a short way beyond, and not being yet quite certain whether there was a way after all, we returned to camp by a higher route, which we decided could be made practicable for animals, even though it could hardly be likened to Pass "G."

The next few days were spent in further reconnaissances, both down the valley, to make certain it was practicable for Clifford and Cave with the ponies, and over the glaciers at the head. Meanwhile the porters were sent back for further supplies from the dump beyond the Marpo La; in fact, from now onwards until the end of the expedition, porters, whenever available, were employed for this purpose, and it remained a difficulty throughout to keep the supply of food and fodder sufficient, and still to retain enough men to carry out the work in the forward areas.

The reconnaissances showed no difficulty down "I" valley, or the Lungmo-chhe, as our men named it.* The gorge was easy and the valley was, in fact, as Wood had already reported, fertile with grass and burtsa. At some period of the year, probably in the winter, animals must congregate here for shelter, for in many places the dung of wolves, burrhel, yak, and kyang lies together in the same sheltered but sunny spots. The valley is crossed by game tracks in all directions, and butterflies were common. The Tibetan snow-cock and many smaller birds were now in the valley with their broods. It was indeed an ideal spot for a new depôt.

Further reconnaissance up the valley showed that this plenty ceased at the gorge below the junction mentioned by Wood. Beyond, there were no tracks, no fuel, and very little bird or insect life. We found, however, a number of fossils. The second glacier was found to block the valley completely, and had torn out the hillside opposite, forming

* See Note on Names at the end of the paper.



3. Teram Kangri from the north-east across the Kyagar Glacier

Gasherbrum I
26,470

Gasherbrum II "Broad Peak"
26,360 27,130

K₂
28,250



4 Across the Kyagar Glacier and down the Shaksgam Valley

From Station W₄

cliffs. Laden porters could still find a way with some difficulty by climbing over them high up, but we were still hoping for a way for ponies. This way we found by crossing the glaciers at about 19,000 feet, well above the serac'ed lower portion, but the long day's reconnaissance, which took us into the valley beyond, told us nothing of this valley. We could not see where it led, and in such a country it was futile to guess; nor could we say whether it contained grass or fuel, though we could see no signs of life.

Clifford and Cave arrived at the head of the Lungmo-chhe on July 26, just as we were beginning to get anxious. They had very wisely taken their marches leisurely, owing to the condition of the animals. Two more of these had died, but the remainder had benefited by the young grass which was now springing up in the Yarkand valley and Lungmo-chhe. They reported the interesting discovery of the corpse of a man in the latter. There were two rupees on him, one of which was dated 1918, and a string of turquoises, so he had evidently died unattended. A little way from the body were six tins of aniline dyes, unopened, and bearing the device of a lion and shield. The man was huddled up, and Clifford was of the opinion that he had died of starvation and exposure about the year 1924. We afterwards came to the conclusion he was probably a Balti, and from discussion with traders, he had probably straggled from the caravan route some five marches to his east, lost his way, and starved to death.

Clifford and Cave had considerably increased their collections of plants and birds, and brought specimens of rock which contained metallic ore. They had come across a large number of burrhel and antelope, and brought us fresh meat, of which we were much in need.

When we were reassembled we again reviewed the situation, and concluded that it would be better for Minchinton, the Khan Sahib, and me to reconnoitre and survey ahead, owing to the doubt concerning grass, while Clifford and Cave supported us from our new dépôt in the head of the Lungmo-chhe. I think we made the mistake at this juncture of pushing on at once, before getting more supplies over the Marpo La; but the weather was fine and we were very impatient to get back to the Shaxsgam. We should have built up a new base here before pushing on; but we did not know then that the Marpo La route would become difficult owing to the fall of seracs on the Lungpa Marpo glacier, and so curtail supplies.

As it was, we crossed the pass—called by the men the Sa-Kang La—with four ponies and all available porters by the high-level route over both glaciers on July 30, camped in the valley beyond, the Sa Lungpa, and sent back every man that could be spared for work on the Marpo La.

The Sa Lungpa was the most desolate valley I have ever seen. There was not a blade of grass or of any green thing, nor was there any sign of life, not even of an insect. We had been accustomed to limestone hills

and disintegrated limestone slopes. Here the slopes were covered with a hard dry mud. After snow, thaw, or rain the hillsides must be liquid. Near the valley bottom the slopes were seamed by countless scorings of streams, and on the flat the mud was baked and cracked by the sun. We had found fossils in the head of the Lungmo-chhe; here we did not find even these.

Our next day was disappointing, and saw the end of our hopes of piercing the "Red Wall." We found that the river broke suddenly to the south-west, but only when we reached the point where the gorge began. We pitched camp, the Khan Sahib climbed one hill with his planetable, Minchinton climbed another to reconnoitre, and I tried to force the gorge with one man. I shall not forget that gorge. We started with ponies, but soon had to abandon them. There was a lot of water coming down the stream, turbulent clayey water surging round huge boulders. We had to jump the stream by means of these boulders several times, or climb the gorge walls to avoid them. They were either washed by the torrent or covered with ice, but we reached a point about a mile and a half down where the gorge opened out somewhat, and I felt that as the river had risen considerably it would be foolish to go on. We had more difficulty getting back than I had expected, and were disappointed to learn from Minchinton that the gorge continued for another 4 miles.

We now had definitely to abandon the hope of using pony transport any further, and sent our four animals back. They reached the glaciers of the Sa-Kang La, whence Clifford had them practically carried down to grass. We also sent back all our coolies during the next day or two to bring up supplies and fuel from the Lungmo-chhe, for there was literally nothing here. The weather also turned bad, and we were within an ace of retreat ourselves.

The trough of the Sa Lungpa continued beyond the point where the river pierced the mountain barrier on the south-west of it, and this trough, still in a north-west to south-east direction, contained another branch of the Sa Lungpa, which flowed towards us in a gorge and joined the river I had tried to descend just below the point I had reached. After making some photo-theodolite stations on the spur at the head of the gorge, and after getting up from the dépôts more supplies and fuel, we moved camp over the mountains to this branch, and pitched it at the junction of two tributaries, near its source. At the head of these we had seen cols which we determined to explore, in the hope of striking "the ancient route." These cols were less than 20 miles from K₂, and we felt that the views from the summit of one of them must tell us much, though we had little hope of having enough supplies and fuel to cross them. The whole Sa Lungpa was as devoid of burtsa or any other form of fuel as before, though again we found a number of marine fossils among the limestone *débris*.

On August 6 we divided, Minchinton with one of the Gurkhas exploring the southern of the two branches, while the Khan Sahib and I ascended the northern one. Minchinton had a very hard day, and reached the head of the glacier which drained into his tributary. He climbed a ridge a little below 20,000 feet, and had a view of K₂ between the serrated peaks of the Aghil range. But at the other side of his col there was no way down for porters.

Our own reconnaissance was much more promising. A quarter of a mile from camp the stream issued from a gorge, and as we had started very early there was not much water coming down it. But it was icy cold, and we had to ford it a number of times. The depth in one place was up to our chests. Quite suddenly we came to the end, and found ourselves on an elevated plateau, 17,500 feet above sea-level. It was almost a replica of the Depsang, and ponies could have been ridden at full gallop across it. It was about 7 miles from north to south, and 5 from east to west, and we felt that if any route had ever existed in these parts it must have crossed this plateau. There was even scanty grass springing up, and a few female antelope with their young gazed at us and slowly trotted off.

Minchinton came back from his reconnaissance rather a sick man, but though he was not well for some days, he gamely came along to the "Aghil Depsang." For the next few days we were exploring the plateau, using all available men for bringing up supplies and fuel. We shot a few Tibetan sandgrouse which passed over, and some female antelope, which seem to seek the higher and more remote ground when they have young. We cooked them on their own droppings mixed with a kind of moss dried in the sun. We searched for any signs of human travel, but though we explored the plateau fairly thoroughly we found none.

Practically the whole of the drainage of the Aghil Depsang is eastwards into "J" valley. Several glaciers push their snouts forward on to the plain, and give the impression of being the remains of a *protective* ice-cap. They are now retreating, without any doubt, and the streams which issue from them are cutting young ravines and gorges across the otherwise level surface. We were now certain that the whole area north of the northern watershed of the Sa Lungpa must also drain into "J," and that therefore any ancient route, such as Wood suspected up "J" valley, must cross the plateau. The western watershed of this "Depsang" rises in places to over 20,000 feet; between the highest points the old ice-cap seems to have *depressed*, though not *eroded* it, and from these depressions come the "crawling" glaciers. There was one depression lower than the rest: the glacier had retreated farther, and the "young" gorge was older and deeper. We determined to explore this, believing that, if Hayward was right in saying that the Kalmuk Tatars had been here, they must have passed over a col at its

head. On August 10 we camped by the snout of the glacier in the "Tatar Lungpa," and the following morning explored the pass.

The glacier was of the saddle type, coming in from the south; it is mostly situated on the east side of the watershed, and therefore drains mostly by means of a long tongue into the Tatar Lungpa. For some distance we kept below the tongue on the slopes opposite, but before reaching the pass took to the ice and found the going quite easy.

Our view from the summit must have been slightly different from that which Sir Francis Younghusband had from the Aghil pass thirty-eight years ago, but it must have been no less wonderful than his, for our altitude was greater. Before us stretched a panorama of mountains and ice, so grand and so vast that it took the mind long to grasp its immensity.

From a little under 19,000 feet we looked across a deep valley—we called it the "Kalmuk Lungpa"—draining a little north of west. At a distance of about 4 or 5 miles this valley turned either to the north or south, or joined the trough of a larger valley lying across it. The Kalmuk Lungpa was enclosed on the south by a rocky crest, draped with glaciers, of a dazzling whiteness. Beyond this crest was a second and a third, carrying some fine peaks, over 22,000 feet. To the left of these rose Gasherbrum I., 26,470 feet, the "Hidden Peak" of Sir Martin Conway, once more revealed in indescribable beauty. And to the west, a serrated line of jagged peaks of 22,000 feet was dwarfed by the mighty pyramid of the second mountain of our Earth, the stainless virgin summit of which played with tiny wisps of drifting cloud.

Altogether we saw this view from the pass on four occasions, and I am going to describe it on our farewell visit some time later. We had decided to pitch our camp on the pass itself, in order to see the sun set and rise. We faced our tents to the west, where was situated K₂. In the very early morning long before it was light, we opened up the tent and waited for the transformation. It was so dark that there was for some time no difference between the darkened sky and the sleeping mountains. Their presence was felt rather than seen. But gradually dawn came up out of the east behind us, and the west grew blacker. Then over our zenith it seemed as though the deep blue-black curtain of the night was drawn down towards the western horizon, till the shadow of the Earth reached the summit of K₂. Quite suddenly the topmost ice was flushed a rosy pink. Light seemed to creep down the mountain's side and gradually to suffuse the whole with life. For a few minutes the giant pyramid was resplendent against the blackness, faintly tinted near the base, crimson at the summit. Then to the south of us, we watched Gasherbrum reveal her morning splendour. Mountains near the two peaks now reflected the living ice with a pale glow; and slowly, one by one, they lifted their heads to the dawn.

I must turn to my narrative. From this pass a practicable route led down to the valley below, and we decided that we must, at all costs,

20,468

23,770



5. Looking south at sunset from north flank of Shaksam Valley, on the way to Lungpa Marpo
From Station W8

22,120

Sa-Kang La

21,808



6. The barren Sa Lungpa looking south-east

From Station W₁₂

descend and see in which direction the big river at the end of it turned. As we had been expecting an outlet to the Shaksgam southwards or westwards since leaving the Sa-Kang La, it seemed that this must flow south. But would it turn into a gorge? And if so, would the gorge be passable?

When we had left our depôt we had not expected to be away more than a week, and we had not built up sufficient supplies for a longer period. Nor had there been any indication that the route over the Marpo La would become blocked by the fall of seracs on the Lungpa Marpo glacier. Clifford and Cave were now having difficulty in keeping us supplied, partly from this cause, partly owing to the fact that the ponies were practically useless, and partly owing to our demands upon the coolies and the swollen state of the rivers. We were therefore delayed till August 19 on very short rations. The time was not wasted, however, and was mostly spent in working on the survey and photography. Bad weather also came on, so that actually little time was lost.

While delayed here two of our Ladakhi porters, Tashi and "Munshi," went down to explore for fuel. They brought us the totally unexpected news that the big river flowed north instead of south. They reported that it was "as broad as the Shyok at Saser." We therefore crossed the Tatar La in a state of high excitement, cairning the route, and believing that at last we might be re-entering the Shaksgam. The descent was down very steep shale to the Kalmuk Lungpa, which we reached at about 15,500 feet. The bottom of this valley was enclosed, but for the first time for many a day we found plenty of grass and fuel and flowers. Our porters were very tired, and though the junction was only 5 miles away in a direct line, the route led over a series of tiring spurs separated by deep ravines, and they did not succeed in reaching the big river that night.

On August 20 we moved on to the junction. The Khan Sahib surveyed from a hill to the south, and Minchinton and I explored on farther down the main valley. We had left the greater part of our warm kit and tents behind on the Tatar La, but instruments and supplies fully employed the men.

The main river—I shall anticipate a little, and call it now the "Zug-Shaksgam"—was, as our men had reported, flowing north, or rather a little east of north, and before long we became almost certain that it was the Shaksgam itself, and that our camp was at the spot that Sir Francis Younghusband had named "Durbin Jangal." We were, in fact, so certain that we were again in the Shaksgam that I actually wrote a letter to Mr. Hinks and told him so, giving the odds at a bottle of champagne to a glass of water.

This valley agreed in almost every particular with that of Sir Francis Younghusband. Just below our camp the stream-bed widened to nearly half a mile; above, it was about 300 yards wide. There were a

certain number of small bushes and plants. The valley was broad and its slopes ended in conglomerate or alluvial cliffs, which appeared to have been cut through by the river rejuvenated. The latitude of the junction was within a minute of that of Durbin Jangal. The water in the river continued to rise until 11 p.m., and then covered a bed 300 yards wide, thereby showing that it had a distant source. There were however three points which made us a little doubtful. The height of our "Durbin Jangal" was about 13,350 feet by aneroid; Sir Francis gave the height of his as 12,329. We explained this to our satisfaction by remembering the vagaries of the aneroid. Our "Durbin Jangal" was a good deal east of the other; owing to the possible misidentification of the peak by Sir Francis at Durbin Jangal, we had been led to expect this. Lastly, our river was flowing a little east of north; that of Sir Francis was shown flowing north-west. But even this fitted in when we turned to his account in the *Proceedings* for April 1892. For the passage here recording the view from the Aghil pass runs: "To the *south-west* you look up the valley"—not to the *south-east*. This, we believe now, was a misprint; but when everything else fitted in, or could be made to do so, the chance of a misprint did not enter our thoughts. Remember that the western watershed of our valley surveyed by us was only about 6 miles from the ridge north of K₂, surveyed by the Duke of the Abruzzi from "Windy Gap;" that no large tributary had been recorded as entering the right bank of the Shaksgam between Durbin Jangal and Kulan Jilga; and that our river was already too low to flow into the Surukwat, or Yarkand river upstream of Bazar-dara.

On August 21 our men were so tired that we decided to give them a day's rest, prior to moving up to the snout of the Gasherbrum glacier. Minchinton, the Khan Sahib, and I started up the valley to look for the best line. We already knew that there was much more water here than there could have been when Sir Francis brought ponies; for he was able to keep to the valley bed, while now this was impassable. The Khan Sahib and I kept as low to the river as possible, and succeeded in getting farther than did Minchinton, who took a higher route. But we came to a spot where we were forced down to the bed, where the river was unfordable, and as the river was rising rapidly, we were forced to turn back. We now discussed the situation, and hoping that the water would subside in the next day or two, decided to explore down the valley and determine, if possible, the position of the Aghil pass. The weather at this time was not good for surveying, for though it was hot and fine, there was a thick haze filling the valley and obscuring the hills; triangulation was quite out of the question.

On August 22 we took a light camp down the valley for some 5 miles, when we came to a point where the hills on the east closed in and the river began to turn westwards. The other side of the valley now opened out, but the river was a foaming torrent, filling the greater part of its

bed, and we were unable to cross. The going at the foot of the hillsides was intensely tiring, for there were great dry streams of granite boulders to cross. These boulders lay in lines, formed fan-shape from side ravines; some were huge, and the troughs between them were often 10 feet deep. We spent two nights here, surveying as much as we could and hoping that the river would subside. But instead, on the second night the water rose 10 feet, and had not fully gone down to normal in the morning. It was still about 5 feet deep, and with a current of about 8 miles an hour, while the most hopeful line to take would be about half a mile long. It would not have been fair to ask loaded men to cross.

Our porters were now showing signs of wearing out, and so were we. One man had already nearly been drowned on his way back to the depôt, and now another was badly bruised by a rolling boulder in a stream. A third had to be left behind today with fever, and fetched in later. They had done splendid work, and I had already raised their wages as some compensation. But now this had no more effect, and when we told them they would soon be on their way home, they merely remarked, "It does not matter; we shall still carry loads." They had lost their old enthusiasm.

If we had now been satisfied, we should have come back with the story that we had regained the Shaxsgam at Durbin Jangal. We should have left the valley on August 26, after a wild windy night on which snow fell, and I believe we could have persuaded you, as we had persuaded ourselves, that this was the Shaxsgam. But we could not feel absolutely convinced of this without actually reaching the snout of the Gasherbrum glacier, and we felt bound to make one more effort to reach this spot. We persuaded the men to make this effort, and on August 26 the Khan Sahib started up the valley. Owing to lack of men and an attack of rheumatism, from which I had been suffering for some days, I decided to follow the next day, after a quiet one with the photo-theodolite.

The river had not subsided in the least since the 21st, but it had changed its course in its bed. The way was difficult in places, but passable beyond the spot we had reached before. About $3\frac{1}{2}$ miles above camp a side stream enters the right bank of the Zug-Shaxsgam. The tributary carried thick red water, similar to that which we had so often seen on the north of the red marble wall. It was just beyond this point that I met the Khan Sahib returning with his men. For about three-quarters of a mile above the "Red Stream" the main valley remained quite wide, and the river flows in a broad flood plain, the slopes above on either side being easy. The bed then becomes more enclosed by steep cliffs for half a mile, beyond which the river issues from a narrow cutting between them, 20 yards wide at the top and only 5 yards wide at the river-level. The water must be very deep, and the cliffs were about 150 feet high above the water. Beyond this gorge the river-bed again opened out for a distance of about $1\frac{1}{4}$ miles, but the way over the cliffs was none too

easy. Again the river issues from a gorge, a veritable cleft, through which the water poured. The cliffs here were only 10 feet above the surface, 3 feet apart at the top, and about 5 feet at water-level. They almost touch in places, so that the river practically flows underground. This extraordinary formation continues for about 400 yards, and then widens to a few yards. Two miles farther there is a sharp bend, and the greater part of the river comes from the south-east, being fed by glaciers ; a smaller tributary joins here from the north-west.

Unfortunately it was quite impossible to reach the bend, owing to a tributary gorge.

Anything more unexpected or more unlike the valley that Sir Francis Younghusband ascended with ponies past the snout of the Gasherbrum glacier could not have been conceived. To my mind there is only one explanation, namely, that this Zug-Shaksgam is the lower course of the Sa Lungpa, whose upper branches we had already explored. There is still room for the river of Sir Francis between our watershed and the mountains north and east of K₂, though there certainly is not room for *two* more valleys of this size.

The question is, Where does this river flow? We had already followed it down to a level which precluded any possibility of it breaking northwards to the Surukwat or Yarkand river. It must enter the Shaksgam therefore between Durbin Jangal and the foot of the Aghil pass. But there is no mention of a large tributary here in the account of Sir Francis. I have since my return had the opportunity of examining his journal, and this throws no light on the point. His rough chalk sketch, however, does show a tributary entering the right bank of the Shaksgam between Kulan Jilga and Durbin Jangal ; and I believe that this must be our Zug-Shaksgam. But it must be very nearly as large as the river he explored.

We had to be content that we had discovered this river, and to leave its further exploration to some future expedition. Our men were now far too exhausted to be asked for further efforts, and the river showed no signs of subsiding and allowing us to cross. The most we could now hope to do was to return to the upper Sa Lungpa, and if the gorge there had become passable, to force a way down it and confirm its identity with the Zug-Shaksgam. We moved in easy stages, for the men had much to carry, and the outcoming supplies to pick up. Also we wished to give the Sa Lungpa waters time to subside. We found however that this river had not become passable, and so returned to our depôt, reaching it on September 1.

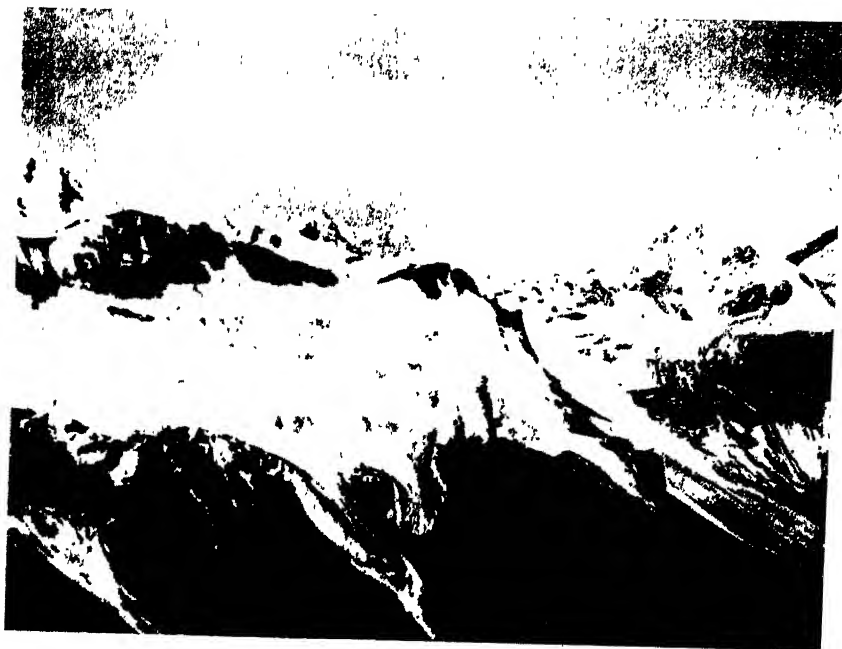
While we had been away Clifford and Cave had studied the conditions of the Lungmo-chhe, and had explored the area between it and the "J" valley of Wood. This area was found to drain through narrow gorges into "J," and not as Wood had surmised. Clifford and Cave followed the gorges for some distance and reached the junction with

Gasherbrum Peaks

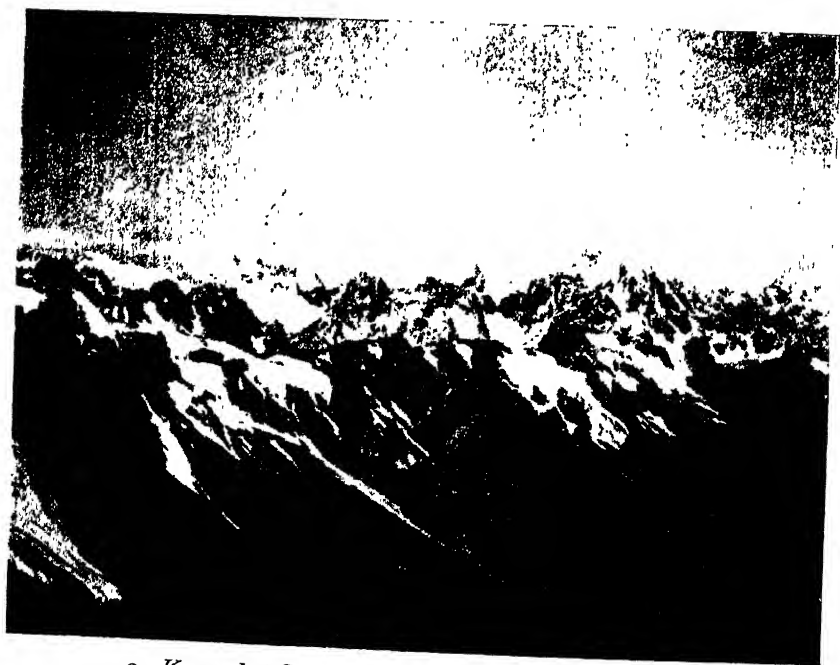


7. The break in the Aghil Ridges above the Sa Lungpa Gorge

From Station W₁₀



8. *Gasherbrum I from the Tatar La*
From Station W₁₅



9. *K₂ and "Staircase Peak" from the Tatar La*
From Station W₁₅

"J" valley, thereby much lightening the task of surveying the area on our return.

The Khan Sahib was now able to survey the whole of the Lungmo-chhe and the area to the north of it, and this gave him opportunities of making some slight corrections to the existing map of the glaciers and watershed on the south of the valley. The tributary containing two lakes, mentioned by Wood, was also surveyed, and, as I have said above, the valley beyond the saddle was found to be blocked by a glacier.

Cave had gone almost back to the Shaksgam by this way, and reported that the Kyagar Thso had extended to a length of over 5 miles.

While we were engaged on these surveys, the porters brought over the last of the dump from the Lungpa Marpo. On September 12, after a spell of bad weather, we sent off the ponies by the Amphitheatre to the head of the Shaksgam to collect the supplies left there for the return journey. The men had orders to meet us in the Yarkand river on the 21st. We ourselves followed with the porters by short marches, for they had to do each journey twice, and sometimes three times. In the Yarkand valley we had our only serious accident. After arrival in camp, Tilak Bahadur, one of the Gurkhas, had climbed the rocks bordering the river-bed, when the hillside gave way and crashed down on him. His skull was fractured, but thanks to Clifford's skill he recovered, though he had to be carried for many days on an improvised stretcher by four men, whom we could ill spare. Our transport difficulties were accentuated by the loss of three more ponies during a snow blizzard, which delayed the rest on their journey to the Shaksgam. Two more ate through their ropes and strayed on the night of the 22nd. We were therefore somewhat thankful to reach the Amphitheatre on September 23, and to find that Ali of Hondar, a pony-man who had accompanied us to the Shaksgam in June, had arrived back at the Amphitheatre the day before, with thirty more ponies, according to programme. After one more day of foul weather, we quitted the Amphitheatre for good and started back for Panamik. The return journey was of course a very simple matter compared to the outward one; caravans were passing along the route in both directions, and the weather was very kind to us during the crossing of all the passes.

We reached Panamik in the Nubra valley on October 3, after having been almost continuously above an altitude of 16,000 feet since we had left it in June. We did not take any maximum or minimum temperatures, but in the Shaksgam and Aghil areas it was not excessively cold, and I do not think we ever had more than 25° of frost at the most, and very rarely as much as this. Fine weather was far more usual than bad, and I should say that 70 per cent. were fine; though on these fine days, many of which were hot, there was always a very high wind, which was always bitterly cold, blowing from the regions of snow and ice to those that were warming up. Some of these winds must have attained a great

velocity, and it is satisfactory to report that the tents which Messrs. Benjamin Edgington supplied, and which you gave us, withstood all these gales. Occasionally on fine days, particularly in the Yarkand valley and in the Zug-Shaksgam, survey work was made impossible by haze, but I cannot say whether this was caused by the heat on the rocks or from the loess of Central Asia. Spells of bad weather were generally heralded by a few days with cloudy skies; the actual spell, however, usually did not last for more than two or three days. Were it not for these spells, it would be possible without excessive discomfort to bivouac without tents; in fact, our men sometimes preferred to do so, rather than carry them; but in these cases, when the weather turned bad, we gave them shelter in our own. At the same time, if there is survey work to be done in the daytime, and computations to be done at night, I consider that as much comfort as possible is essential during sleep.

Cave, in his meteorological notes, reports that in his regular observation of cirrus between May and September, there was no single record with an easterly direction. The high currents almost universally came from the west or south-west. Among other points of interest, he made notes on winds, sun-halos, haze, and the succession of colours at sunrise and sunset.

Clifford was the only one who had some difficulty in sleeping over 17,000 feet, but he is not a good sleeper at sea-level. Both the Khan Sahib and I found that altitude had a distinct tendency to make us inaccurate, and the worry of computing on more than one occasion gave us headaches over 17,000 feet.

The health of the whole party was good, except for a few minor troubles, and except for the accidents I have mentioned. But towards the end several of the men developed coughs, and Clifford's opinion was that they would not have been fit for much more work. I am sorry to have to record so much mortality among our animals. Of the twenty-one animals which I bought, ten died; of these, four died from lack of grass and altitude, three from exposure during a snowstorm, one from colic, one from pneumonia, and one dropped down dead with a heart attack. Four yaks died during or after the crossing of the Khardong pass in June, and sixteen of the hired animals died from various causes.

Before closing, I wish to thank Minchinton, Clifford, Cave, and the Khan Sahib for all their help during the expedition. Minchinton's knowledge of mountaineering was a very great asset, and even when he was unwell and could hardly walk, he refused to be left behind. He was indispensable. I was very sorry to have to leave Clifford and Cave at the *dépôt* when we went over the Sa Kang La. Cave had practised with the photo-theodolite and would have been invaluable. Both he and Clifford, however, turned their energies to collecting, and I believe their collections of birds and flowers are as complete as possible. Clifford's skill as a surgeon was happily not often required, but it is due to him

that we all came back. Of the Khan Sahib I cannot speak too highly. He was always ready to turn his hand and his mind to any job that was going, and his beautiful and accurate survey has been much admired. He has asked me to thank you personally for the award of the Back Grant last year.

From preliminary investigations of the butterflies and birds, examined by Colonel W. H. Evans and Mr. Hugh Whistler, there appears to be no new species of either. About two-thirds of the species of butterflies are identical with those secured by Capt. Hingston on my survey expedition to the Pamirs in 1913. I understand from Mr. Whistler that the main interest of the bird collection lies in the high altitude at which some of the migrants were secured.

I am not going to finish without a word of praise to the Ladakhi porters. They were absolutely splendid; they came of their own free will, and once they had put their trust in us they never gave us a moment's real worry. It is quite impossible for me to overestimate their services, but you must have realized to some extent their pluck and loyalty.

GEOGRAPHICAL OBSERVATIONS AND CONCLUSIONS

The Muztagh, or Karakoram Range.—The great range of snowy peaks which number among them K₂, the Gasherbrums, and Teram Kangri, has for some years been known to European geographers as the Karakoram. This name, as Wood rightly remarks (Wood, p. 7), is given by the Central Asian traders to the pass alone, and not to the mountains. Wood surmises that it was Hayward who first suggested applying the name to the mountains. Hayward certainly used it,* but he also employed the other—Muztagh—as well, as did Sir Francis Younghusband; and it seems to me a little doubtful whether he intended to apply the name “Karakoram” to the line of the great peaks. Both names are Turki, so cannot be considered alternative, especially when it is remembered that the one means “Black gravel” and the other “Ice mountain.” My own belief, after studying Hayward's account, is that he meant to use the name “Karakoram” only for the unexplored system of mountains west of the Karakoram pass (see *Geogr. Journ.*, 1869). To this day traders allude in a vague way to the snowy mountains which they know exist to their west, but which they can barely see, as the “Muztagh.” I believe it a misunderstanding of Hayward's account, and of the observations of Montgomerie, of the Survey of India, that has led European geographers to use the term “Karakoram range” as it is at present applied. Montgomerie used the symbol “K” for all the peaks he measured which appeared in the direction of the distant range, and at the station of Haramukh, near the Wular lake in Kashmir, he first observed “K₂,” entering it as such in his angle book.†

* Burrard states that Moorcroft was the *first* Western geographer to apply the name “Karakoram” to the great range which separates the Indus and Tarim basins (Burrard, p. 97). The objection to the name Muztagh which Burrard cites, viz. that there are other “Muztaghs” not on this range, applies equally to the name “Karakoram.” There are several Karakorams, or Karakurams, in Turkistan and on the Pamirs; and the Karakoram pass itself is on a subsidiary fold of the Aghil range.

† It may be of interest to state that Montgomerie's entries of the Karakoram

I do not think that Montgomerie believed for a moment that K_2 should be considered on any particular range, for certain of the "Ks" are on a southern alignment. But I certainly believe that the naming of K_2 has influenced geographers in retaining the name for the range.

One of the direct results, I am sure, of denoting the line of the great peaks by this name has been to insist that the Karakoram pass itself must lie on it. The Karakoram range has on some maps been made to bend out of its normal alignment, to almost due east, in order to include this pass. The great divide between the Nubra and the upper Shyok, which is even yet only very imperfectly surveyed—barely reconnoitred, I should say—has been allowed to sink into geographical insignificance, though it carries four triangulated peaks of over 24,000 feet, one of which attains 25,000.*

I feel certain now that, as I hope to prove later in this paper, the true axis of the Karakoram range follows the alignment of the Upper Shyok—Nubra divide.

The Source of the Shaksgam.—Prior to the De Filippi expedition of 1913-14, the map of the region west of the Karakoram pass, with the exception of the pioneer sketches of Hayward and the rougher ones of Johnson, was almost a blank. Farther west we had the results of the explorations of Sir Francis Younghusband; but the trough of the Shaksgam east of the meridian of Teram Kangri was purely conjectural, and from the maps its main source might have been the Urdok glacier.

Wood's explorations during that expedition led him to surmise that the source of the Shaksgam river was very much farther east than had been supposed, and to publish his conviction that the Yarkand tributaries, "I" and "J," had their sources in a range north of the Shaksgam. Wood also traced the alignment of a "Red Range" north of "J" valley, and showed it with a north-west to south-east alignment. Nevertheless, he did not consider that the country as a whole was sufficiently well surveyed for him to state his opinion that the accepted alignment of the Karakoram range was wrong; and it was not till I reached Panamik on the way back, that I received a letter from

peaks in his angle-book for the station of Haramukh, together with their present heights and names, accepted by the Survey of India, are as follows:

K_1 (west)	..	..	Masherbrum west	..	..	25,610 feet
K_1 (east)	..	..	Masherbrum east	..	..	25,660 "
K_2	..	..	K_2	..	..	28,250 "
K_3	..	..	Gasherbrum IV.	..	..	26,000 "
K_{3a}	..	..	Gasherbrum III.	..	..	26,090 "
K_4	..	..	Gasherbrum II.	..	..	26,360 "
K_5	..	..	Gasherbrum I.	..	..	26,470 "
K_6	..	..	Karakoram No. 8	..	..	25,110 "

The "Broad Peak," 27,130 feet, as far as I can remember, is hidden behind the Gasherbrums in the view from Haramukh; it was not observed by Montgomerie. Gasherbrum I. is the "Hidden Peak," and Karakoram No. 8 is the "Bride Peak" of subsequent travellers.

* Burrard implies that the Nubra and Upper Shyok *both* drain from the north of the Karakoram range (Burrard, p. 98). But he was uncertain owing to lack of data, and the name of the range has not been shown on maps according to Burrard's views, which were written prior to Longstaff's discovery of Teram Kangri, and the correct alignment of the main watershed.

Wauchope tentatively showed the Karakoram along the whole of the Nubra-Shyok divide; the watershed south of the Saser pass is as yet insufficiently surveyed to say whether he was correct (see below).

him stating that he agreed with the conclusions in my Journal, and that he himself had formed a similar opinion some years previously.

The work of the present expedition has confirmed Wood's surmise concerning the source of the Shaxsgam, and Pass "G" may be considered as lying at its most distant head. The high massif carrying several peaks of 22,000 feet and some large glaciers, draining into "I," "D," and to the Shaxsgam itself, may be considered another equally important source. But neither the glacier by Pass "G" nor this massif contributes as much water as the great ice-streams of the Karakoram, such as the Kyagar, the Urdok, and the Gasherbrum. Although no vast amount of water reaches the upper Shaxsgam from the northern wall of its valley, the majority of the drainage of these mountains finding its way into the Shaxsgam lower down, by the large tributary which we discovered, yet the combined effect of the whole basin must be far greater than that of the Yarkand river above Khufelang. I feel convinced, therefore, that Sir Francis was right in suggesting that the Shaxsgam is the true geographical source of the whole Yarkand river; at any rate, its basin supplies by far the greatest volume of water.

The Kyagar Glacier.—From the junction of the two highest tributary sources, near which junction was placed our first dépôt, the valley of the Shaxsgam trends only a little north of west. At latitude $35^{\circ} 40'$, longitude $77^{\circ} 10'$, the valley is blocked by the Kyagar glacier, draining from the snowy cirque of the "Apsarasas group" of the Workmans.* The Kyagar glacier has a large open névé basin lying under the wall of the Karakoram, divided by two large spurs into three heads. From the junction of these heads, the combined ice-stream becomes a tumbled mass of pinnacles which continue for 6 miles thence to the snout, which is crushed and contorted against the marble cliffs opposite. It is difficult to describe these pinnacles. Some rise to a height of 200 feet and are of the most beautiful transparent blue ice, while others are opaque. Between them there are occasional short moraine bands, but in the lower reaches of the glacier these are by no means continuous and afford no passage either up, down, or across the glacier without a very great deal of step-cutting. Many of the "leads" that I examined through my glasses ended in glacier lakes of considerable size, and of the most beautiful turquoise and sapphire colouring imaginable. Near the "snout spread" these pinnacles are distinctly dangerous, and I saw more than one fall into the Kyagar lake.

The Kyagar Lake.—The Kyagar lake, formed by the damming of the valley by the glacier, is a very remarkable feature. When first discovered it still carried the remains of its winter ice. During the early part of the year very little water enters it, and the percolation drainage through the glacier dam more than counterbalances the supply. The winter ice is thus left unsupported and breaks, falling in great blocks to the hillsides and valley bottom. We were in time to see many of these lying along the slopes, giving a very good indication of the winter surface of the lake. But the level was rising even early in July, showing that the percolation is really not great. Towards the end of the month the lake had increased 500 yards in length and probably about 15 feet in depth. Clifford and Cave saw it again about a month afterwards, when it had extended a further $2\frac{1}{2}$ miles, giving a total length of somewhat over 5 miles. Along the hillsides and for several miles up the valley there is a series of parallel beach lines, scoured by the lap of waves at each high level

* I should here like to pay a tribute to the triangulation of Mr. Grant Peterkin, of the Workman expedition. His points were easily recognizable from the north.

of the lake, and which appear as though some one has been scratching contours on the slopes. These lines must give the high-water marks of the lake in different years, and are therefore a measure of the height of the glacier dam and to some extent of the fluctuation of the snout. There is no doubt that the dam has been considerably higher than it is at present, as can be seen from the beach-lines, and when it was so the snout must have turned down the valley. It has certainly worn down the cliffs opposite, carried away the *débris* from the mountains above, and is still polishing the marble. It is, however, impossible to say definitely whether the glacier is advancing or retreating.*

The Shaksгам below the Kyagar Glacier.—The cliff against which the Kyagar snout impinges is the visible termination of a long range of red marble, extending in a north-west direction, and carrying peaks some of which exceed a height of 22,000 feet. The Shaksгам, continuing on approximately the same course as before, therefore deserts this wall, which at a distance of 6 miles from the Kyagar snout is replaced by another enclosing ridge bounding the valley on the north. This appears as an "island ridge" from the hills east of the Kyagar glacier, and rises in one place to 23,000 feet. It also has a north-west to south-east trend, and between it and the red marble range, which we used to refer to as the "Red Wall," a new north-west to south-east valley is disclosed. The Shaksгам river, however, now begins to bend to take a parallel alignment, and must eventually cut across the line of the "island ridge."

The course of the Shaksгам from the source by Pass "G" was accurately surveyed as far as the beginning of the island ridge. From here the planetable fixings were not sufficiently far apart to give good intersections, and the work cannot be considered of the same standard of accuracy, though it is hoped that the Wild photographs will improve it in this respect.

Beyond the bend north-westwards the river must lie between the ground surveyed by the Duke of the Abruzzi in 1909 and that surveyed by us. The gap between the two surveys is only 6 miles wide, and as the latitudes of Sir Francis Younghusband have never been questioned, the position of the river can be placed on the map with very little margin for error. It is now possible, therefore, to insert the snouts of the Urdok and Gasherbrum glaciers.

The south boundary of the Shaksгам valley may be considered as the line of the great peaks—K₂, the Gasherbrums, Teram Kangri—but this watershed is more distant than the "Red Wall" on the north. The spurs projecting from the northern rim of the Rimo and from Teram Kangri have a north-west trend, and I believe that it will be found that the glaciers farther west, *i.e.* the Urdok and the one from the Teram Kangri, have a similar course.

A glance at the survey will show at once this curious north-west to south-east trend of the main features. Even the smaller tributaries on the north bank of the Shaksгам, east of the Kyagar snout, flow south-east and then bend right round to join the Shaksгам in a westerly direction. It appears at once as though the Shaksгам river is cutting a course diagonally across these ridges.

* An interesting parallel to this lake occurred in 1926 in the upper Shyok behind the Kumdan glacier. The glacier burst early in November, and the pent-up waters swept down the Shyok, damaging the valley for a distance of 300 miles and destroying the suspension bridge of Tirit and the village of Deskit, near the Nubra junction. The waters must have been confined in the Shyok gorge below the junction, for they flooded *up* the Nubra valley to beyond Panamik, where some caravans were destroyed. Dr. Longstaff gives the results of his investigations concerning previous blocking of the upper Shyok valley by the Kumdan and Aktash glaciers in the *Geographical Journal*, vol. 35, 1910, p. 649.

The Aghil Range.—When the party transferred its base to the head of the Lungmo-chhe, the watershed was crossed at the Marpo La. To the north-west stretched a group of peaks over 21,000 feet in altitude, and these were again seen later and surveyed from the head of the Sa-Kang La glaciers. This group, also of red marble, with some red boulder conglomerate, extends north-west and borders the Sa Lungpa valley on its south-west side. The axis is parallel to that of the Shaksgam "Red Wall," but separated from the latter by at least one subsidiary glacial trough. The two branches of the Sa Lungpa, from south-east and north-west, meet in the north-east boundary of the range, cut through it in a south-westerly direction, collecting the drainage of the glacial troughs, and, as far as we could see from hills at the head of the gorge, the whole appears to be thrust against the "Red Wall" and forced north-west. It seems highly probable that it is only separated from the Shaksgam by the "Red Wall," and eventually becomes the Zug-Shaksgam, which we explored from the Kalmuk Lungpa.

To sum up: The range bordering the Shaksgam on the north—part of the Aghil range of Sir Francis Younghusband—may therefore be described briefly as a chain comprising three and possibly four axes of crystalline limestone, parallel to each other and with a north-west to south-east trend. It carries a number of peaks above 22,000 feet and one at least above 23,000 feet.

The Head of the Lungmo-chhe and the Sa Lungpa.—The trough of the Sa-Lungpa and of the northern source of the Lungmo-chhe also lies parallel to the prevailing trend, and this trend is now seen to conform to the strike of the rocks, which are stratified and which yielded fossils. But the drainage is far less regular, for the Lungmo-chhe drains into the Yarkand river, and thence past Khufelang, while the Sa Lungpa cuts a gorge into the Aghil range, and must eventually join the Shaksgam river. The Sa Lungpa trough is also very different from that of the Lungmo-chhe in other respects. The latter is conspicuously fertile for this part of the world, and contains plenty of grass and burtsa, while the Sa Lungpa goes to the other extreme and is the acme of desolation.

The north-western of the two saddle glaciers of the Sa-Kang La extends right across the valley, definitely blocking it and forming the south-east source of the Sa Lungpa. The north-west branch of the Sa Lungpa has two sources: one from a glacier lying on a ridge of the Aghil range, and the other draining through a gorge from the Aghil Depsang. The trough is continued beyond the glacier source by the deep valley of the Kalmuk Lungpa.

I have said above that the Sa Lungpa must find an outlet eventually into the Shaksgam. I believe that the Zug-Shaksgam is actually the lower course of the Sa Lungpa; and to my mind there is no doubt that this river must join the Shaksgam somewhere below Durbin Jangal, owing to the altitude to which we followed it. Yet it is curious that Sir Francis did not record any tributary, and I can only suggest that the Zug-Shaksgam becomes confined in a gorge before reaching the main river.*

The Country north of the Lungmo-chhe and Sa Lungpa.—The country north

* Sir Francis Younghusband has very kindly allowed me to examine his original journal written on 12 September 1889. He writes: "... Nothing particular to note on march, and I have been very busy fixing my position accurately with regard to the main range, and have no time to write."

His rough chalk sketch-map, however, does show a tributary entering the right bank of the Shaksgam between Kulan Jilga and Durbin Jangal; I believe this will be found to be Zug-Shaksgam.

of the Lungmo-chhe is much more worn than that to the south, being of a softer limestone and very much crushed shale. But here too there are traces of the same north-west to south-east trend. The ranges are not so continuous, and are frequently cut by gorges. The barren country between Wood's "I" valley (Lungmo-chhe) and his "J" was, contrary to expectations, found to drain into "J" valley. Wood's party was only in this valley for a very short time, throughout which it experienced continuous bad weather. It is therefore hardly to be wondered at that the surveyor did not get the drainage of this basin quite correctly. The five points ascended on the watershed north of the Lungmo-chhe by members of my party, together with the reconnaissances of Major Clifford and Captain Cave down the gorges to "J" valley, leave no doubt that Khan Sahib Afraz Gul Khan has drawn this area correctly, though, as he did not actually see the valley bottoms owing to the gorges, the contours have been shown by broken lines. This country is almost as barren as the Sa Lungpa, and probably more so than "J" valley, for burtisa was found in a side valley close to the latter.

The Aghil Depsang.—It has been recorded with what surprise my party discovered the Aghil Depsang. After toiling along the barren Sa Lungpa, trying to find an outlet to the Shaxgam, being saturated with ideas of the general trend of the country, nothing was more unexpected than a high open plateau. The greater part of this plateau drains into "J" valley, giving it a very large basin. The strike of all outcrops of rock which were measured followed a south-east to north-west trend, but today the ranges across the plateau, if they ever existed, have been completely worn down, and it seems to me that they were never of any great significance.

The Aghil Depsang is about 7 miles from north to south, and about 5 miles from east to west; it is therefore somewhat smaller than the Depsang south of the Karakoram pass. But the similarity between the two is very remarkable. Both have the same broken stony surface, with "squelchy" river-beds; both have isolated hills of *débris* and disintegrating limestone; the drainage of both is from their west margins across the plains, and not from a central watershed. Both give a scanty grass, apparently identical, but no burtisa; for both are at the same altitude, 17,500 feet above sea-level. Both can be very hot in summer sunshine, or perishing cold with bitter winds drawn to the warming area from regions of ice; and to both the female antelope brings her young, away from wolves and other molestation. To the west of each there is a range, the features of which are remarkably alike. But there is one difference: in the region of the Depsang, the Kizil Lunga has captured the drainage of the glaciers; while at present, the Sa Lungpa has not yet cut back far enough to take much of the waters of the Aghil Depsang. This difference is, I believe, due to the later retention of the icecap on the latter, remains of which are to be seen in the form of great "crawler" glaciers stretching on to the plateau. Yet these last appeared to me to be retreating, for young gorges are now being cut in the soft rock by the glacier waters, and it may not be long, geologically speaking, when the last dissimilarity vanishes.

The "Red Range."—Before passing to a consideration of the ranges as a whole, it appears desirable to mention the "Red Range." Colonel Wood records its existence north of "J" valley, and states that he observed it extending for some distance on both sides of the Yarkand river. For some distance of its length he surveyed it. We never had an opportunity of visiting it, but it was a conspicuous feature from many of our stations. It appeared to us to extend as far as Bazar-dara, and in a south-westerly direction we observed it on

22,470

23,050

21,290



10 The Shaksam-Zug-Shaksam divide from the Tatar La

From Station W15



11. Looking up the Zug-Shaksgam towards its Gorge
From lat. $36^{\circ} 00' 56''$, long. $76^{\circ} 52' 47''$

both sides of the Yarkand river, making roughly in the direction of Balti Brangsa. This is of interest, for I received a letter from Colonel Wood during my journey back, in which he writes :

"The Red Range is, I feel pretty sure, a watershed, and I think that it and the range just west of the Yarkand river and continuing south-east are one. The Yarkand cuts through it, just north of "J," and the other branch of the Yarkand river, which starts from the Karakoram pass and along which runs the trade-route, cuts through it between Balti Brangsa and Baksam Bulak. . . ."

This was written quite independently of our observations, which are however, in entire agreement with it. I am uncertain how far to the south-east this range extends, for no modern survey has been made beyond longitude $78^{\circ} 15'$. Nevertheless, on our return journey across the Depsang plains I could see distinct traces of what appeared to be the same red range north-east of the Chipchap.

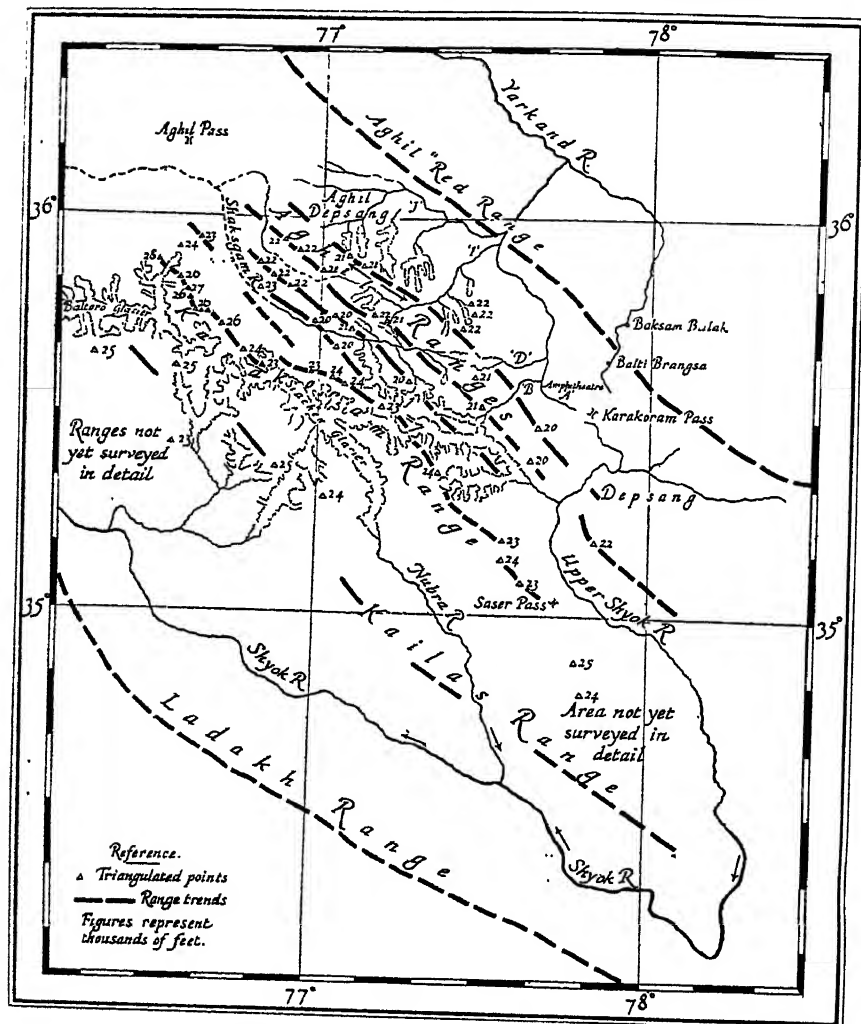
After considering this "Red Range" in connection with the "Red Wall," I am inclined to include it among the "Aghil mountains." The width of the Aghil range embraces both and comprises the several parallel ridges described above.

Extension of the Aghil Range.—Having established the general trend of the ranges and ridges in the area of our survey, it was natural to try and follow the extension in both directions. North-west of us this was not easy, for the country was cut across by the large river, the Zug-Shaksgam, which eventually held us up at the end of August. But I am of opinion—and this is rather in the nature of a guess—that either the Shaksgam "Red Wall" or the "Island Ridge," may be originally an extension of the north-west to south-east range seen by and photo-surveyed by the Duke of the Abruzzi's party from "Windy Gap." If this is the case, the main Shaksgam cuts through these outer walls. Whether it penetrates the whole of the crystalline core of the Aghil range, and passes between it and the stratified alignment further north, can only be decided by further exploration. If it does, and from the sketches of Sir Francis it appears most probable, then the course after the westward bend will be found to lie in a continuation of the Sa Lungpa-Kalmuk Lungpa trough.

It was the south-eastern prolongation of the Aghil chain that afforded the most interesting results. The Shaksgam "Red Wall" is almost certainly continued along the southern watershed of Wood's "H" valley, towards Pass "G," and I should not hesitate to place its continuation along the northern watershed of the Rimo glacier. There is a marked geographical and structural similarity between the Depsang peaks and those on the south-west border of the Sa Lungpa, and the Burtza river cuts a gorge through the range above Murgo, remarkably similar to the gorge of the Sa Lungpa, which checked us early in August. The walls of the two gorges appeared to me to be of identically the same rock, and the towering peaks are of very much the same appearance. The Sa Lungpa gorge is certainly much narrower and more difficult, but this I think would be explained by the smaller rainfall and consequently slower rate of erosion.

I am in my own mind quite convinced that the Aghil range as a whole, and very probably its component ridges as well, can be traced south-eastwards from longitude 77° , north of the Rimo, through the Depsang peaks and plateau to the gorge above Murgo, and possibly beyond. The similarity of the two Depsangs, and the discovery of marine fossils along a line parallel to the trend, though perhaps no definite argument in themselves, strongly support this theory.

The Karakoram Range.—This conception of the Aghil range must necessarily change the old one of the Karakoram bending through the alignment of the Karakoram pass. I am unfortunately not acquainted with the southern aspects of the great peaks of this range from close quarters, but they have been amply described by Sir Martin Conway, Sir F. De Filippi, Dr. Longstaff, and



The Trend of the Aghil Ranges

the Workmans. As I have mentioned earlier, there are some very great peaks, culminating in one of 25,000 feet, on the Shyok-Nubra watershed, imperfectly surveyed it is true, but exhibiting very marked points of similarity to K_2 , the "Broad Peak," and Teram Kangri. There are no peaks attaining this altitude or bearing the same visible points of similarity, perhaps the most striking of which is the association of a granite core with crystalline limestone, on the range

described above as the Aghil. Godwin Austin has suggested that this association of granite and limestone occurs in K_2 ; De Filippi has reported the same in the case of "Broad Peak"; and both Dr. Longstaff and the Workmans have recorded limestone near the head of the Siachen glacier. We observed the same in the neighbourhood of the Saser pass—a fundamental basis of granite, but associated with limestone.

From a glance at the map as a whole, insufficient though certain parts of the survey are from a modern aspect, it is apparent that a very high watershed between the upper Shyok and Nubra extends from the Saser pass north-westwards to the head of the Rimo glacier and thence to Teram Kangri. Major M. L. A. Gompertz, who was surveying in the neighbourhood of the Saser pass this year, also formed the same opinion independently that this watershed is the Karakoram range. One particular point of interest in connection with his work is his surmise that there is a large glacier beyond the head of the Mamostong,* draining westwards or north-westwards into the Nubra, and not towards the upper Shyok, as has been generally supposed.

There is one further argument, small in itself, but with some weight if added to the rest. The type of glacier beyond the Saser range is similar to that beyond the Karakoram. All are of the strange "pinnacled" type. But the first large glacier encountered west of the Saser pass—the Mamostong—is the usual type of cis-Karakoram glacier, blackened and flat.

How far the Nubra-Shyok watershed can be considered as an extension of the Karakoram it is impossible to say at present. My own belief is that the upper Shyok cuts through it below Kataklik; but a modern survey of this whole watershed is necessary before this point can be settled. It is however obvious that if the foregoing conception of the Karakoram be accepted, the pass of that name lies many miles from it, and some revision of nomenclature appears to be desirable.

The Ancient Route.—One of the questions we were especially anxious to investigate was that of an ancient route across the area surveyed. There are many references to this route, and I cannot do better than refer the reader to the appendix to Colonel Wood's report. Practically every traveller to these parts has heard the tradition of an ancient pass between the Nubra or Skardu and Khufelang. This pass, if it existed, must have been west of the Karakoram pass, and east of K_2 . The references are now so numerous that, difficult though the country is, they can hardly be ignored. Before starting I had read all the notices of the route that I was able to find, and can add only one of any interest to the list of Colonel Wood. It is from a serious native route report of the last century:

"Another stream called the Yarma or Nobra flows from above the Changlung, which was anciently traversed by a route to Khapulung. This route was closed by the people of Nobra, who, by throwing in of charcoal, helped the formation of iceblocks, which obstructed the passage altogether."

Although we failed to resurrect the lost art of making 45 miles of ice by means of charcoal, and although all inquiries in Leh, in Nubra, and among traders, with one exception, led to nothing tangible, I for one felt almost certain that we should find traces of an old route in continuation of the cairns dis-

* This glacier is wrongly named "Murgisthang" on maps. See Note on Names at end.

covered by Vigne, Longstaff, and the Workmans. The one exception referred to above was an old trader in Leh who had a story that "a rajah's caravan" had attempted to penetrate by that way, and had completely disappeared; but that adventurous spirits would sometimes go forth in search of his treasure. None, however, came back to tell their tale.

Actually we found no traces of treasure or travel, ancient or modern, except the body of a man. But though I believe this corpse to have been a straggler from the caravan route, at least four marches distant, and though the saddlebag discovered by Wood may have the same interpretation, I still believe that it is possible there was an ancient way by which a few people, possibly "Kalmuk Tatars," robbers or fugitives from justice, might have migrated or escaped. If they did so they must have selected October, for this would be the only month when they could get through the gorge above Khufelang, up the enclosed valleys and gorges of "J," over the Aghil Depsang and Tatar La, across the Shaksgam and its tributaries, and still be fit and ready to tackle the glaciers and passes of the Karakoram before cold and exposure would exterminate them. I do not consider there is any possibility of their having travelled up the Lungmo-chhe, for there are too many difficulties in the matter of finding a route from it, whereas "J" valley, though barren, leads directly to the Tatar La. Any party must have suffered great hardships, but it would probably be independent of cooked food, and hardships were presumably in the daily nature of things. But I am absolutely certain that the through route has not been used for a very great number of years.

It is of course possible that we missed some traces of human passage. In a country where all nature is on strike, it is possible that fireplaces may be few and far between. Nevertheless from the time we left the trade route towards the end of June until the time we struck it again towards the end of September, the sole signs of human occupation were the blackened stones of Wood's camp fires in the Yarkand valley and the Lungmo-chhe and the corpse of a single stranger.

Area left to be Surveyed.—We do not claim that there is now no survey work left to be done. But I think we have accomplished all that is possible during the summer months, at any rate from this side, except perhaps in the north-west corner of "J" valley to the "Red Range" of Wood, and the high massif at the head of "D." There is also the survey to the north of the "Red Range," into which area we were not allowed to go. But the rest of the blank must be filled in by a party taking either the Aghil pass with animal transport, or the Shingshal with porters on foot. In both cases the so-called "open" season is closed, and the cold weather must be the time selected. Whether the late autumn or early spring is best for the passage into the area, I am unable to say, for it seems to me to depend entirely on the time of the finest weather. But I think, if I was to go again, I should winter in Gilgit, cross the Shingshal early in February, survey the Shaksgam valley first and the great tributary glaciers after the spring avalanches have fallen and before June; it would then be possible to get clear of the rivers before the summer floods.

NOTE ON NAMES

Colonel Burrard remarks in his 'Sketch of the Geography of the Himalaya': "The nomenclature of a mountain region should not be forced: it should grow spontaneously, and we should never invent a name until its absence has become inconvenient." In the area of our explorations there were but two names in existence, the Shaksgam valley and the Aghil range; and neither

K₂
28,250

20,868 "Island Ridge"

22,969 22,802

22,521

"Red Wall"



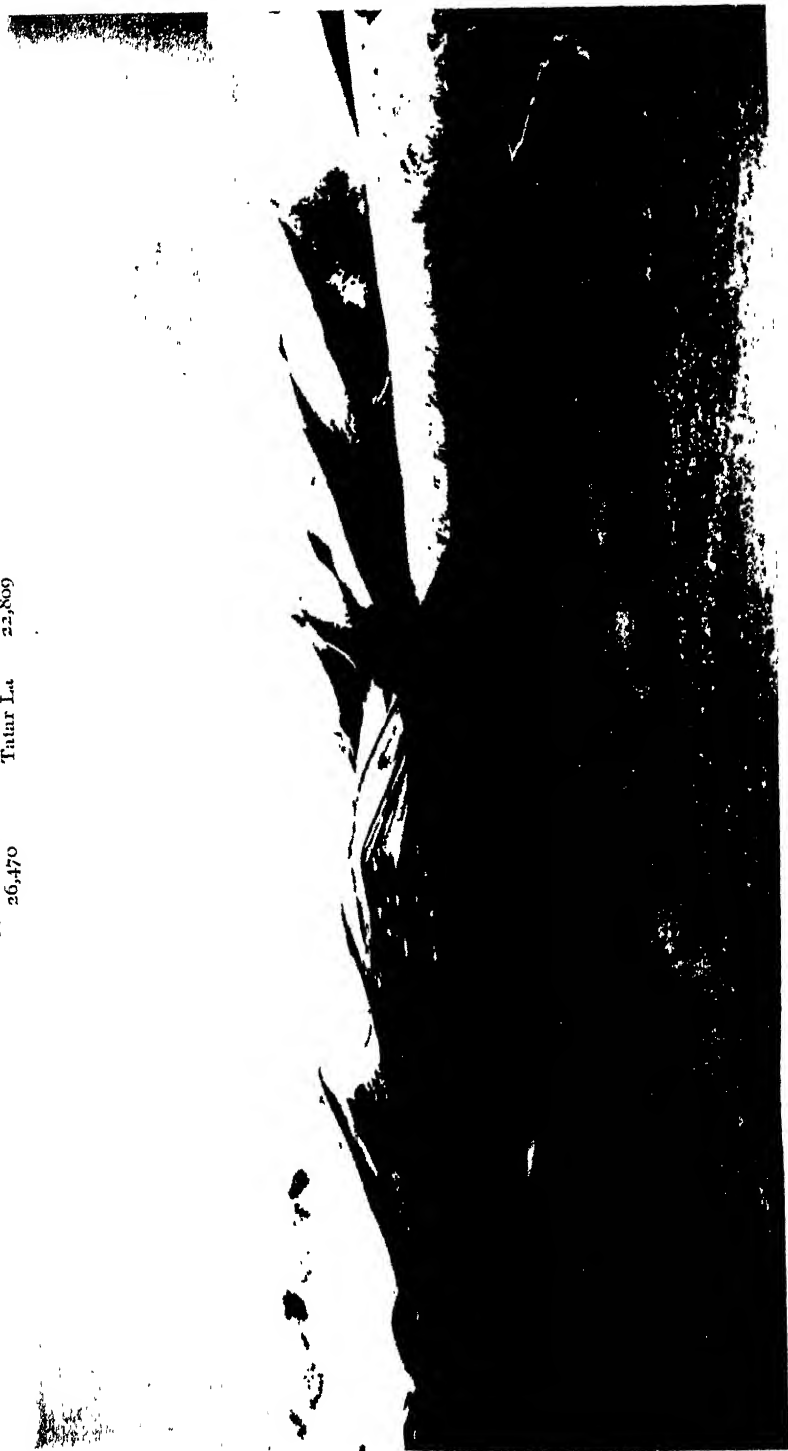
12. The Red Wall and the Island Ridge, Aguil Range

From Station W6

Gusherbunum I
26,470

Tatar La

22,809



13. The Ag'il Deysang and the Tatar La

From Station W14

of these was known to any of our men. The absence of names *was* inconvenient, and something had to be done about it.

Colonel Wood's system on our east margin was to employ the alphabet: though he expressly stated that the letters he used were to be considered provisional, in all the correspondence before our expedition these letters had to be used. The tendency is therefore for provisional names, however one may wish to the contrary, to become permanent. Such is the case with *K₂*, the second highest mountain in the world: the symbol was used first in Colonel Montgomerie's angle book, and it has permanently remained.

Our own system was an attempt to follow Colonel Burrard's principle; and we encouraged our men to name places. It is interesting to note that they never named a single mountain, and the names they gave to passes and valleys had to be dragged out of them. I am however convinced that these names do mean something to them, which the alphabet does not. On our return to Leh, we called one of our men before Mr. Kunick and one of his native pastors of the Moravian Mission. Each name was reconsidered, and its derivation and suitability investigated. The resulting names are given below. All are in Ladakhi, which is a dialect of Tibetan. I would add that along the trade route, both Ladakhi and Turki names are used indiscriminately, and I am adding at the end some of the Ladakhi names used on the trade route, with their meanings, as far as we could ascertain.

(a) *Ladakhi names applied to the area of our explorations.*

Kyagar Thso, "The grey white lake." (Deriv. *Kya* or *skya*, grey; *gar* or *kar*, white.)

Kyagar Kangri, "The Kyagar Glacier." The word *Kang-ri* means "ice mountain." To the uneducated native mind, a large glacier is an ice mountain, and the peak at its head merely a protuberance at one end of the mountain. As *Kang-ri* is used by educated Tibetans and Europeans to denote mountains and not glaciers (e.g. Aling Kangri, Teram Kangri), it would lead to confusion if we were to use "Kyagar Kangri" for the glacier. I therefore use the expression "Kyagar glacier." (In this connection, the old name for the Siachen glacier is "Saichar Ghainri." I believe this is really "Siachen Kangri," which was the name given me in Panamik for this glacier.)

Marpo La, "The Red Pass." (Deriv. *Marpo*, Red.)

Lungpa Marpo, "The Red Ravine" or "valley." *Lungpa* is placed first by the men for euphony.

Lungmo-chhe, "The Big Valley." (The word "*chhe*" is a suffix, derived from "*chhenmo*," meaning "big." Strictly the valley should probably be "*Lungpa chhenmo*." But for euphony, we were told, a Ladakhi would always use the suffix, and convert the noun into its feminine form.) This is Wood's "Valley I."

Sa-Kang La, "The Earth and Ice Pass." (Deriv. *Sa*, earth; *Kang*, ice.) This pass, at the head of the Lungmo-chhe, consists of two convergent saddle glaciers whose snouts join, but whose trunks are separated by a tongue of land.

Sa Lungpa, "The Valley of Earth," or "mud." As already noted, the slopes and valley bottom were covered with a layer of mud.

Shaksgam itself appears to mean either "the Box of Pebbles," or "the Dry Pebbles." (Deriv. *Shak(ma)*, pebbles; *Gam* or *sgam*, box, or possibly *kam* or *skam*, dry.)

Zug-Shaksgam, "The False Shaksgam."

Dizma La. *Dizma* seems to mean "many coloured." The rocks on this pass were of a mauve and violet tint.

Kadpa-ngonpo La, "The Blue Rift Pass." (Deriv. *Kadpa*, rift or quarry; *Ngonpo*, blue.) This pass lies close to the Karakoram pass and at the head of Wood's "Valley A." Near the pass there is a blue scar from a fall of the hillside. I suggest the word *Lungpa Ngonpo* ("the blue valley") for "Valley A."

The Aghil Depsang, the Tatar Lungpa, the Tatar La, and the Kalmuk Lungpa were named by us without reference to our men.

(b) *Names on the trade route.*

Pang-dang-sa, "The grassy plain." (Deriv. *Pang* or *Spang*, turf; *dang* or *thang*, plain; *sa*, earth, ground.) A camping-ground for caravans west of the Saser pass.

Skyangpo-chhe, "The great wild ass." (Deriv. *Skyang* or *Kyang*, wild ass; *-po*, male; *-chhe*, big, see above under *Lungmo-chhe*.) A camping-ground west of the Saser pass.

Mamo-stong, "The thousand demons." (The spelling on old maps *Murgis-thang* seems to me to be incorrect. We were told that a legend existed that a large number of "bad men" from Central Asia were killed by an avalanche on the Mamostong glacier, and that the derivation was *Mamo*, demons; *stong*, thousand.)

Ang-gar-shak. Meaning doubtful; derivation seems to be *Ang(gyag)*, junction of ice and the mountain side; *gar* or *kar(po)*, white; *shak(ma)*, pebbles. The meaning may be "a moraine," for the trade route here traverses a moraine west of the Saser pass.

Bong-ro-chan, "The Place of the Dead Ass." (Deriv. *Bong(bu)*, a baggage ass; *ro*, a corpse; *chan*, having.) A locality just west of the Saser pass.

Sa-ser, "Yellow Ground." (Deriv. *sa*, earth, ground; *ser*, yellow.) The name is given first to a spot in the upper Shyok, and from this the pass becomes the "Saser La."

Depsang, "The Open Plateau." (Deriv. *Deps* or *Ldeps*, elevated plain; *sang* or *sangsang*, open, clear.)

The spelling for the glacier explored by the De Filippi expedition should, I think, be "Rimo," not "Remo." There appears to be no word in either Turki or Ladakhi, with the *Raymo* sound. *Rimo*, in Ladakhi means either a picture, band, or stripe. It is just possible that the word may be some derivative of the word *Ri*, a mountain; but we were told that in such a case, the word would probably be something like "*Rimo-ri*." I cannot explain why. The word *Rimo* is a very common one in Ladakhi, in the sense, "a picture." Most of the assistants in the Survey of India at the time of the Kashmir survey, 1855-1864, spelt the names exactly as they sounded in English; if this was the case with "Remo," this should now be spelt "Rimo."

The Ladakhi does not seem to have a great number of topographical terms in common use; and he does not appear to discriminate much between a ravine and an open valley. He seems more concerned with how the word appears to his sense of hearing. He may use the word *Trokpo*, which seems to mean literally a mountain brook, for quite a large side tributary; and he will use the word *Lungpa* (or its feminine form, *Lungmo*, if he chooses), which is more strictly a fairly large side valley, to denote a brook. The word *Lartsa*, which means literally "the foot of a pass," is generally used for the *camping-ground* at the foot. But *Pulo*, which actually means a "shelter hut," seems to be used just as often, regardless of whether there is a hut or not. *Brangsa*, a

"camping-ground," is also somewhat loosely used in the same connection, but more often away from the immediate vicinity of passes.

NOTE ON THE MAP

The map reproduced with this paper is a reduction of the planetable survey by Khan Sahib Afraz Gul Khan of the Survey of India on the scale of 1 inch = 2 miles. This survey was based on triangulation by Major Mason with the Wild photo-theodolite. The stations of the trigonometrical survey were resected from uncained peaks triangulated by Colonel Montgomerie, Grant Peterkin (Workman expedition, 1912), Colonel Wood, and Commander Alessio (De Filippi expedition, 1914).

The Karakoram watershed on the south and south-west is from surveys by the Workman expedition (Siachen glacier) and the Abruzzi expedition, 1909 (Baltoro glacier head, K₂, the Gasherbrums). The Yarkand river on the east and north, and the lower part of "valley J" are from Colonel Wood's surveys with the De Filippi expedition.

The pioneer work of Sir Francis Younghusband has been shown in broken lines, with parallels showing his observed latitudes. When the Wild stereo-photographs have been worked up, more detail in the Shaxsgam valley, and some of the northern spurs from the Karakoram range will be shown.

DISCUSSION

Before the Paper the PRESIDENT, after referring to the loss the Society had sustained in the death of Sir John Scott Keltie, said: To-night we are met to hear the report of the successful issue of an unusually important expedition in which this Society can claim to have had a share: it gave considerable help to that expedition and provided some of the most essential equipment. Some particular results of an instrument which this Society provided you will see upon the screen to-night, and I think that presently you will agree with me that they are among the most remarkable views of mountain scenery that have ever been taken. Major Mason, who is giving us the report, was the leader of the expedition. We have also present one other member of it, Major Clifford. We are sorry that the two other British officers are still overseas. Major Mason, who has carried this expedition through under very arduous circumstances in a country which is as remote from human habitation, apparently, as anything in the Old World—I rather fancy that he and his expedition were the only inhabitants of the particular Himalayan valleys into which they penetrated—will give us the authoritative account, necessarily curtailed by the necessity of keeping within bounds of time and also of not attempting to give too much detail by oral delivery. His full report will be published later in the pages of the *Geographical Journal*. I will now ask Major Mason to give you the report of which I speak.

Major Mason then read extracts from the paper printed above, and a discussion followed.

Sir FRANCIS YOUNGHUSBAND: In case I forget to do so later, I must commence by associating myself with all that Major Mason has said as regards the splendid work of the Ladakhi coolies he had with him. No one who has undertaken explorations in those parts can fail to understand how much he is indebted to those men upon whom, fundamentally, the whole success of the expedition depends. It is a great delight to me to know that the fine old

traditions of the Ladakhis, their staunchness and loyalty, are still maintained. They do not help entirely for the sake of pay, because after all what explorers are able to give them does not amount to much. The Ladakhis have a real spirit of adventure. I am quite sure that when any one comes along who is out for a big adventure the Ladakhis are ready enough to join, and it is by appealing to that spirit of adventure that one gets the best work out of them.

Next, I want to say how much this whole expedition owes to Mr. Hinks. Major Mason has alluded to that, but I should like to add my own tribute, because here at this end I have been able to see what Mr. Hinks has done, and I wish particularly to acknowledge the help that he has afforded me. As a help to Major Mason, he looked out many of my old diaries and observation note-books, together with that old map of mine that you saw on the screen, and with his topographical instinct he was able, from a phrase in my diary here, from an observation in my note-book there, and from a tributary on my map—from these various indications to make my simple and rough reconnaissance shine out with a brilliance I never imagined it could have! By such aid he has enabled Major Mason and me to join together in a most unexpected way, much to the delight of us both.

Now I come to Major Mason himself. Well, Major Mason goes back to that day when he was a fine healthy baby a week old and I stood on the Aghil pass and first saw the Shaxsgam river and all that magnificent region. Lest any one here should think that I am one hundred years old, I should like to say that I was then only twenty-four—the ideal age for an explorer: for at that age he has no experience and does not know a difficulty when he sees one, the result being that when he comes to a difficulty he sails serenely through it and only when he is safe on the other side discovers that it was one. Very fortunately, I had not to encounter the same difficulties which Major Mason had, because I was only what an American lady explorer once described as a “valley thumper.” I went up the valleys and when I came to a range I sneaked over it by the lowest gap I could find. But Major Mason, by the nature of his calling, had to climb the mountains to take observations of the great peaks, and you must have seen from the photographs what immense difficulties he had to contend with. Yet in spite of all those difficulties, and in spite of apparent failure at the very climax of his journey when he had reached the tributary but could not say whether it joined up with the Shaxsgam river or not, he did go just far enough to be able to join up not only his accurate survey of the peaks with the surveys of the Duke of the Abruzzi and with the old Survey of India of the K₂ region, but also with that rough reconnaissance of the river valleys which I made in 1887 and 1889. Therefore he successfully accomplished the task on which he set out and which was attended with so much unexpected difficulty. As a result of the work of Major Mason himself, of his indefatigable colleague, the Khan Sahib Afraz Gul, and of the other members of the expedition, we now have an accurate map of that region which joins up with the Duke of the Abruzzi's farthest surveys and just leaves room for my rough reconnaissance of the Shaxsgam river in 1889.

And now that that map work is done we can get on in future with the real business of a geographer, which I always consider to be the description of the beauty of the region which he is in. And this particular region is one of the finest in the whole world. The photographs you have seen to-night have given you some idea of it. We generally hear from travellers in such regions as this that it is not possible to describe the beauty of what they have seen, but at any rate Major Mason this evening, with the gallantry of an explorer, has

made some slight attempt to achieve the impossible, and he has given us an idea of what the beauty of K_2 at dawn can be. What I very much hope is that some time just one traveller by himself will go up into that K_2 region and then, with nothing else to think of now he has a map made for him, devote himself entirely to describing either in words or (like the great predecessor of Major Mason in the Survey of India, Colonel Tanner), in pictures what the glories of it are. I do not suppose that in the whole Himalaya, except perhaps in Nepal, where Mount Everest can be seen from the south, is there such a magnificent array of mountain majesty as may be seen in that splendid panorama of peaks— K_2 , 28,250 feet; another peak of 27,000 feet; four others of 26,000 feet; and others of 24,000 feet. The distinguishing features are the ruggedness and jaggedness, the austerity and dazzling purity of those mountain summits. And not until we have a description in painting or in words of the beauty of this region will the geography of it be complete.

In conclusion, I should like to say what an immense satisfaction it is to me to feel that the means by which we have been able to join up the rough reconnaissance I made in 1889 with the entirely accurate survey made by Major Mason was by observation of the stars for latitude. I like to feel the stars joined in our minds with those highest mountains. And now, Major Mason, I should like to congratulate you and the officers with you upon the splendid results of your arduous work. I hope you will have many more opportunities of bringing before the Society the beauties and grandeurs of the Himalaya.

Major R. C. CLIFFORD (Indian Medical Service): The lecturer is essentially a geographer and a surveyor and, I think you will agree with me, a photographer. He has mentioned that the valleys through which we were surveying and exploring contained no other inhabitants, but I think he has rather forgotten the animal life which we saw there. All along the Yarkand and its tributaries we came on many herds of antelope, the same Tibetan antelope that exists to the east in the Chang-chhenmo, and in Tibet. I am told that this is interesting because it shows that these antelopes exist much farther west than was previously recorded. Also on the lower slopes of the hills in the valley which Colonel Wood called "I" valley, and which is now named the Lungmo-chhe, there were large herds of burrhel, which were undoubtedly the same species as are found nearer towards India, though heavier in the head than those found towards the Karakoram range. I do not want to start a discussion as to whether there are two kinds of burrhel or not, but we found dead heads of 36 inches, which is an enormous size compared with those which are nowadays shot on the nearer ranges. On the expedition we never saw a live head of more than 28½ inches, but I think this is possibly because we were limited in the extent of our exploration by our funds, which were provided for a special purpose and not for shooting. But should anybody want to go where he can get burrhel very easily and also some very interesting heads of antelope, I advise him to undertake the journey across the Yarkand river into the Lungmo-chhe. The road by the Yarkand river is very easy, once you get over the Saser pass and the Depsang plains. In the Lungmo-chhe valley there are a number of protected spots.

There is another interesting question which I think somebody ought to be able to work out if he can get there earlier than we did. We reached the Yarkand river towards the end of June, which is, I think, too late to see the trek of the herds of wild horses which live up in that part of the world. These animals have made for themselves a regular path along both banks of the Yarkand river, and the contouring of the hills is so level and so extraordinarily

cleverly done by these animals, that if you follow the paths you never get up against a snag; they take you round edges of most extraordinary cliffs and deep depressions which it would take hours to get in and out of, and you can walk along them without thinking for a moment that you will get lost or come up against difficulties. We were, unfortunately, just too late to see these herds of wild horses, but I am sure they come there by their markings, which were quite fresh, and they extend right up near the head of the Lungmo-chhe; but they stop short of the gorge which exists before you get right up into the glaciers which Major Mason showed in his picture at the head of the valley.

The rest of the fauna are a sort of mouse-hare, quite common in other parts of the Himalayan regions, and a certain number of birds. We came across birds which are represented in India and in the higher Himalayas by almost identical types, such as the wagtail and finches of various kinds. These have been collected to some extent by various people in that part of the world, and I suppose it will be of interest for these bird collectors to know that Captain Cave has made a very thorough collection of one, if not two, specimens of every type of bird seen. The only bird he did not collect was the duck—much too valuable for other purposes!

So far as the insect life went, I am afraid it was very disappointing. Major Minchinton, among his other duties, chased a few butterflies up and down the hills when he saw them—the heights were somewhat extreme for such exercises—and in the earlier part of the expedition a few of the commoner butterflies were caught. Other insects there were none, except large numbers of black spiders. We tried to work out the derivation of the word Karakoram. We knew "Kara" meant black and that "koram" means gravel. But I tried to prove it meant spiders, because there are so many black spiders there.

The bird and animal life is absolutely interdependent. I saw a remarkable incident when I was sitting at a certain height to which I had followed a very fine specimen of antelope. Suddenly I saw a movement on a rock. At first I could not make out what it was, but after watching carefully I saw it was a huge eagle. Suddenly it made a dash for the base of another rock. Then I heard a squeal. The eagle tried to rise, and on going closer I saw it had rather a large specimen of a mouse-hare by the back. It had its claws into it and was trying to pick it up, but the rock was in the way, and the mouse-hare had turned on the eagle and held it by one of its outer feathers. Suddenly the feather pulled out, and up went the eagle and the mouse-hare with it. The winter brings heavy snow and the animals all take shelter. There are signs and markings of different species in the same spot. One side had sheltered wolves, the other side burrhel; it was all there for any one who cared to read.

The only living thing that appears to be unable to depend upon the other living things in those parts is man. He must go up there supplied with everything, and it is to Major Mason's everlasting credit that we were able to be quite independent of the animal life there, because he made most wonderful arrangements. We had all our food put away in boxes, and we were a self-contained party and able to divide up at a moment's notice. It was all through him. I have never enjoyed an expedition so much, thanks to the wonderful arrangements Major Mason made. Nothing could have been done more economically or efficiently, and if the expedition has in any way failed to get the ultimate results that were hoped for by Major Mason and its members, it is certainly no fault of his. I thank you very much for having given me an opportunity of congratulating him on such a fine show.

Colonel H. WOOD (Survey of India): I should like to unite with Sir Francis

Younghusband in congratulating Major Mason and his companions on the conclusion of a very fine piece of exploration, and to thank him for his very interesting lecture and also for the really extraordinarily beautiful slides of mountain scenery that he has shown us. The country which he has been describing is of peculiar interest to us in India, because it is probably the only part of the frontier of India which is still entirely unknown. Major Mason has added a great deal to our knowledge, but there remains a goodly portion about which we really know absolutely nothing. As Sir Francis has said, the district probably contains the finest group of mountains of any similar area in the world. I have had the good fortune at various times to pass along the north side of practically the whole of the Himalayas, a side which is not very often seen, but from where one gets better views than from anywhere else, and I certainly have never seen such scenery as one finds in the Karakorams. The fact that Major Mason was very much impressed by its beauty cannot therefore surprise anybody who knows that neighbourhood. It is beyond words to describe the mountains which are there. Possibly somebody may paint it, but I very much doubt whether any one can describe it really as one thinks of it and sees it in one's mind's eye. This part of the world has also particularly a peculiar interest to me, because for at least nine years it was my hope and ambition to have done this exploration myself. When I had the good fortune to be attached to the De Filippi expedition in 1914, and in October of that year we talked about the pass we had found into this country, Sir Filippo De Filippi and I said: "The war cannot last for long; it will shortly be over, and in 1916 we will go and do this exploration." During the whole of the war I thought about it, and for several years after it was over we both tried our utmost to get permission to go there. I actually did eventually receive permission in 1923, and had made all my plans and got my stores sent up to Srinagar, and ponies were being collected for me in Leh and I was on the point of starting, when a telegram was received from England in India saying I was not to go; and so, after many years of thought, the disappointment was too great, and I passed my plans on to Major Mason, who agreed to carry on. I therefore feel rather the godfather of this expedition, and I would like to congratulate Major Mason very much on the work he has done.

There is only one point I should like to mention, and that is, as I have such a personal interest in the valley I cannot refrain from expressing a wish that he had pushed a very lightly equipped party across the glacier and allowed it to take a march or two down the valley to see where it led to. You have heard how difficult it is to say where the rivers go, and until some one has actually been down this valley, I am not at all sure that some further surprise may not await anybody who goes. I do not want to dispute Major Mason's wisdom in deciding to go across the range to the north. I should certainly, in his place, have done the same thing. It is rather being wise after the event, but I cannot help feeling that I should like that some one had gone down that valley.

There is one other point, one which Major Mason did not touch on to-night, but which is given in his full report. He suggests that the name "Karakoram" should be changed to "Muz-tagh," and as he quotes a letter of mine, I am afraid this might lead you to think that I am in agreement with that suggestion. I do not like changes of names. I do not think they are advisable, and more particularly when a name has been in existence, as this one has, for about sixty or seventy years. It is quite possible that the Karakoram pass is not on the main axis of the ranges known as the Karakorams; I think when the name

was given, sixty or seventy years ago, it was intended as a regional name, very much like the Himalayas and many others of mountain regions. The mass of mountains is generally known as the "Karakoram," and not as the "Karakoram range." To apply definitely that name to one particular ridge, as has sometimes been done, is, I think, a mistake; because I do not consider we have sufficient knowledge at the present moment to say how all the various ridges run. I therefore would like to register a protest against any change of the name. I am sorry, however, to have to disagree with Major Mason, and I hope he will forgive me, particularly after the very interesting lecture that he has given us to-night.

The PRESIDENT: As no one else wishes to address the meeting, it falls to me to claim that Major Mason's report has amply justified the expenditure to which your Society has gone and those very strenuous labours of Mr. Hinks, about which Sir Francis Younghusband spoke. I can fully endorse what the latter said. Nothing within the last year has aroused so much interest in the Secretary and, in spite of his very arduous duties, has caused him to devote so much of his off-time to the support of exploration as the preparations for the expedition of Major Mason. This has been, as you see, very successful, though it has not completed the work in the district. I hope that Major Mason may go back. There is still evidently much to be discovered there. I imagine it is practically impossible for an air-survey to pass down those valleys and for an aeroplane to fly low over the top of that extraordinarily unattractive-looking glacier; therefore, if anything more is to be learnt about this region it must be by Major Mason going back and possibly pushing a light party across the glacier: though I am bound to say that I find it difficult, after looking at the photographs, to imagine how any party, either heavily or lightly laden, could possibly go over it. I am sure we all owe much gratitude to Major Mason for the report that he has given us, and for having so amply vindicated the Society's purchase of a Wild photo-theodolite. The lenses attached to the cameras must be of the very first class to bring out such wonderful mountain views as those which we have seen.

We also owe a considerable debt to Major Clifford, not only for what he has done, but for the very interesting sidelights which he has thrown upon other work of the expedition about which Major Mason had not time to speak. I should like to know, having looked at the photographs shown during the evening, on what antelope live. However magnificent the scenery—it is the most magnificent you can conceive upon this Earth—I failed to discover in the foreground, at any rate, of nine out of ten of the photographs, anything on which even a hare could live, much less an antelope. But I dare say that the great scale of the scenery and the distance at which many of the photographs were taken have concealed from our eyes the vegetation which animals find when the migrations take place. I am sure all of you must echo the wish of Major Clifford, that somebody should go there when these migrations are actually taking place. The only things at all comparable to them are the great bird migrations.

A vote of thanks has already been moved in substance, if not in form, to Major Mason by Sir Francis Younghusband and seconded by Colonel Wood, the "godfather" of the expedition; and I am sure that you will accept that vote of thanks and signify your acceptance in the usual manner to Major Mason.

Dr. LONGSTAFF writes: I would like to add a note on the very interesting Geographical Conclusions printed at the end of the paper. I am very glad

that a geographer of Major Mason's authority openly proclaims that the Karakoram Pass, though it is on the Indus-Yarkand water-parting, is *not* on the range of mountains of that name but on an extension of the Aghils, while the Saser Pass is truly situated on the crestline of the Karakoram range. The main axis of elevation of this great fold can be traced through Sir George Cockerill's Malungi Dias north of the Hispar Glacier, through K₂ and the Gasherbrums, through Teram Kangri, along the crest of the Saser Pass; and on through that great group of peaks rising to over 25,000 feet between the Nubra and Shyok rivers: further, I am quite confident that Major Mason is fully justified in believing that the Shyok River cuts through the main axis of the Karakoram range below Kataklik, as I think Sir Sidney Burrard recognized. When Major D. G. Oliver and I were route-hunting in the mountains to the east of the upper Shyok River we found those same crystalline limestones which Major Mason alludes to—and an impracticable mountain barrier which must extend to the neighbourhood of the Changchhenmo (*vide Geogr. Journ.*, 35, p. 646). But while heartily agreeing with Major Mason's alignment of the main axis of the Karakorams I would insist that to the south of this and separated from it by the almost continuous trenches of the Hispar-Biafo and the Baltoro-Siachen glaciers there lies a second great mountain chain, through Rakaposhi, Mango Gusor, Masherbrum, and the Bilafond (Saltoro) peaks, so that our Karakoram system includes at least two parallel ranges (*loc. cit.*, p. 625). The north-western to south-eastern trend of the topographical features discovered by Major Mason in the Aghils is duplicated by the very remarkable topography of the upper valleys of the Nubra and Shyok rivers, indicating that the whole of this vast region has been elevated by the same pressure from the north-east. The appearance of newness and instability of these Karakoram ranges is most striking: their gorges, precipices, and avalanches are more terrific than in the Great Himalaya itself; they have not yet been smoothed and combed by denudation, not yet "shingled" for the convenience of climbers: the age of their rocks has no necessary connection with their age as mountains.

It is not easy to reconcile any precise systematic definition of what constitutes a particular mountain range with the apparent chaos presented to us by the face of Nature. Major Mason does not suggest any alteration of nomenclature, and it is rash even to approach so thorny a subject. But with a fairly intimate knowledge of both ranges I have long regretted that the name Kailas is officially attached to this southern range of the Karakoram—especially as I also know the great Tibetan mountain of that name. Though there are naturally certain differences between the northern and southern aspects of these mountains I am impressed by the essential unity of these two parallel ranges of the Karakoram system. There are most certainly *no* native names for any of these ranges as a whole, therefore our nomenclature must be admittedly arbitrary: even the separation or division between the Hindu Kush and the Karakoram seems quite arbitrary when you are looking at it. Now the Muztagh Pass lies truly on the main axis of elevation, and the application of that name to this portion of the Karakorams by Hayward and others had a good deal to recommend it. But it has been officially and definitely discarded. The accepted name Karakoram has a local application to a very ancient and important caravan route; but the pass of this name, though it is situated on the Indus-Yarkand water-parting, lies well to the north of both the ranges under discussion, as Major Mason points out. Bearing in mind the above considerations, I venture to suggest that it would be convenient to use the name

Karakoram, or Karakorams, or Karakoram-Himalaya for the entire mountain complex between the valleys of the Indus-lower Shyok and the Indus-upper Shyok, and from Gilgit to the Changchhenmo: the use of one of the latter forms of the name would help to dissociate the range from the unrelated Karakoram Pass.

That peculiar pinnacled ice formation of the glaciers on the north side of the range is, of course, not due to any inherent quality of the ice compared to that on the south side, but to the fact that the main axis of the Karakoram, and not the local water-parting, constitutes a definite boundary between two different climatic *régimes*. I am confident that the causation of these pinnacles is due to the incidence and interplay of radiation and evaporation, both of which depend very greatly on the humidity of the air. The drier zone, with pinnacled glaciers, is reached as soon as the Saser Pass is crossed, several marches before the Karakoram Pass is reached. I am very interested to learn that in the opinion of Major Gompertz there must be a large glacier draining westward beyond the head of the Mamostong (or Murgisthang) icefield, because this seems to explain a problem which has long perplexed me. I expect that this will be found to discharge into that surprisingly large ice-free valley which joins the lowest bend of the Siachen glacier on its left bank (*loc. cit.*, p. 644). When it is desired to survey this unknown corner, will the party please proceed 5 miles up the Siachen Glacier and take the first turning to their right? The finding of the Tibetan Antelope on the newly discovered Aghil Depsang, so far to the west of its known range, is a most interesting discovery: a beautiful example of suitable edaphic and ecological conditions inducing migrations on the fringe of a species-area. Similarly, we found the Shapu considerably north of its known range at Zdongpolas, on the northern bank of the lower Shyok river, because just there occurs one isolated area perfectly suited to its habits. In his delightful contribution to the discussion Major Clifford was rather unfair to humanity, reflecting on man's inability to support himself in these inhospitable regions. Man could there only support himself by the chase, and since the game is all migratory he could only exist as a seasonal nomad, like the wolf. Unfortunately, game will not arrange its migrations to suit the convenience of explorers—not even in the "friendly Arctic." I am gratified that Major Mason admits the dulling effects on the mind of long residence at high altitudes, because I have so often been contradicted about this. I *should* like to know what he *really* thinks about the beneficial effects of working for three and a half months at 16,000 feet, and how much more acclimatization would determine success upon Mount Everest? A very eminent mountaineer (*Appalachia*, December 1926) has recently advocated a whole year's acclimatization as a preliminary.

May I express my pleasure in the full recognition which is now accorded to the accuracy of Sir Francis Younghusband's observations during his pioneer explorations of forty years ago? Major Mason has somewhat stressed his own failure to reach the actual tracks of our former President, but the gap is so small that we may safely consider that the problem is solved beyond any doubt, and had his ponies or even a light foot-party been able to push straight down the main Shaksgam valley, we should not have had the survey of the extraordinarily inaccessible and interesting Aghil mazes. I wish to congratulate most sincerely Major Mason, Major Minchinton, Major Clifford, Captain Cave, and Khan Sahib Afraz Gul Khan on the accomplishment of a most difficult and arduous piece of work.

Note added by Major Mason.

I am extremely grateful to Dr. Longstaff for his valuable note. It also gives me an opportunity of removing a misapprehension from Colonel Wood's mind, and of developing more fully what I had in my own. Dr. Longstaff is right: I did not suggest altering the name "Karakoram" back to "Muztagh," and it was perhaps because nomenclature is such thorny ground that I hesitated to tread it. Now however an angel has led the way, and the fool may follow.

Dr. Longstaff alludes to the southern range, for which Sir Sidney Burrard suggested the name "Kailas" in 1906. At that time the alignment of the ranges was dependent on the old reconnaissance maps of Colonel Godwin Austin and his colleagues. Colonel Godwin Austin himself told me that in 1861 they were expressly instructed not to waste time over the survey of barren ranges above 15,000 feet. Since those days we have had the detailed surveys of Sir Martin Conway, the Duke of the Abruzzi, Dr. Longstaff, the Workmans, Sir Filippo De Filippi, and Colonel Wood himself. The discoveries of Dr. Longstaff concerning the Karakoram axis north of the Siachen glacier in particular, emphasize the parallelism and essential unity of the Karakoram ranges. I claim a similar unity and parallelism for the Aghil ranges beyond the Karakorams. The time has come, not for reversion to discarded nomenclature, but for considering how existing names can best be applied to avoid confusion.

Of the three alternatives which Dr. Longstaff suggests for the Karakoram mountain complex, I think the last is the best, but I would extend this name, "Karakoram-Himalaya," north beyond the Shaxsgam trough, to include the Aghil ranges, and *at present* I would not define the northern boundary. This regional name would then include the "black gravel" area of the Turki traders, and an "abode of snow" well within Indian borders. It would include all the "Ks" of Montgomerie and all the Karakorams, Eastern, Western, and Central, of subsequent travellers. This employment of the word "Karakoram" also connects these ranges one with another in a lateral sense, and the essential unity that Dr. Longstaff emphasizes is made clear. The several ranges might be named for convenience, the "Kailas-Karakoram," the "Muztagh-Karakoram," and the "Aghil-Karakoram." In the first of these we have the alignment of the Tibetan Kailas range suggested; in the second—the true ice-mountains—Muztagh becomes the defining word, and the Muztagh passes now lie on a Muztagh-Karakoram range; and in the third, we have both the Aghil pass and the Karakoram pass on the Aghil-Karakoram range. These are only suggestions; and they are bound to meet with certain criticism. It is of course essential that the opinion of the Surveyor-General should be ascertained before any steps are taken to attach any of these names.

Regarding the dulling effects on the mind at high altitudes, I can speak only unscientifically. I believe that there is at first a tendency for the mind and body to become acclimatized. With good nourishment and no cares it might be possible to remain acclimatized, though I doubt it; and such conditions are practically impossible. Worries, anxiety, and preserved food all have a cumulative effect, and both body and mind are strained after long residence at high altitudes. I am quite certain of one point: though physically and mentally fit at the end of our journey, we were all suffering to various degrees from this strain; and both physically and mentally we tired much more easily than when we left Panamik on the outward journey.

May I conclude by associating myself and my colleagues with the remarks

of Dr. Longstaff concerning the accuracy of Sir Francis Younghusband's observations nearly forty years ago, and may I add that Sir Francis has been the master-pioneer by whom successive Karakoram travellers have ever since been inspired?

EXPLORATIONS IN THE GRAND FALLS REGION OF LABRADOR

Varick Frissell

THERE is no map of Labrador showing detail approaching accuracy. The small amount of scientific knowledge we have comes almost entirely from one source: "A Report on Explorations in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicouagan, and Portions of other Rivers in 1892-93-94-95, by A. P. Low, B. Ap. Sc." (Geological Survey of Canada, Annual Report, 1895). Indeed, it was Mr. Low who awoke Canada and Newfoundland to the fact that Labrador in general and the Grand Falls region in particular were worth having. He reported that the latter region contained vast deposits of hæmatite and magnetite rich in manganese. The mining would be facilitated by their proximity to a tremendous waterfall, estimated capable of generating nearly 5 million horse-power. Gradually it has been felt that this area would become the key to development of the entire Peninsula. From this centre would radiate power to grind forests of spruce into pulp, saw trees into lumber, and to electrify the proposed railway.

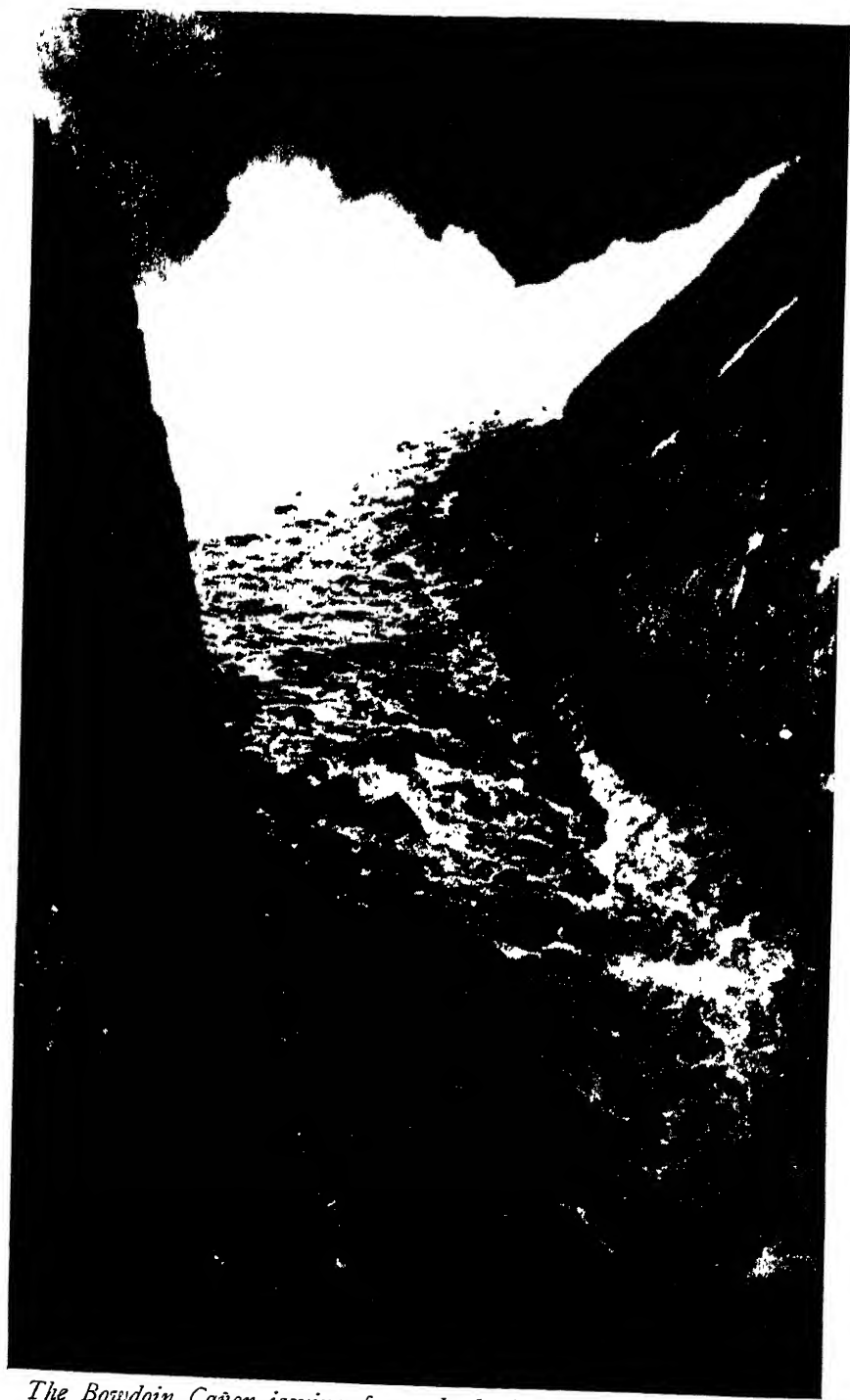
Realizing the geographical problems in the vicinity of Grand Falls, Mr. James Hellier, an undergraduate of Yale University, enthusiastically agreed to help me explore the region. Since prevailing clouds of dense vapour had prevented Messrs. Bryant and Kenaston, as well as Mr. Low and others, from obtaining suitable photographs of Grand Falls, we determined to camp on the spot until favourable conditions permitted our making not only still views but moving pictures as well. Next, we determined to discover the function of Valley River, for we had reason to doubt that it drained Lake Ossokmanuan, as Mr. Low indicates on his map. Lastly, we proposed to explore the "unknown channel" mentioned in Mr. Low's report (p. 139), but disregarded entirely on his map. This channel was evidently an important tributary of the Hamilton, and by trappers on the coast was alluded to as the "Unknown River." In 1921 Mr. J. G. Thomas had seen a high fall presumably on this same stream,* and Dr. Wilfred Grenfell had written to me about it, encouraging more thorough exploration.

In July 1925 we began the 300-mile journey up Hamilton River to

* In September 1924 we had received a letter from Mr. J. G. Thomas with an account of his discovery in May 1921 of twin falls on what he thought was the Valley River, and with photographs. After some delay in hope of obtaining prints more suitable for reproduction, a note on the discovery was published in the *Journal of the Royal Canadian Geographical Society*, Vol. 18, No. 1, 1924.



The Grand Falls of the Hamilton River, Labrador



The Bowdoin Cañon issuing from the basin below the Grand Falls

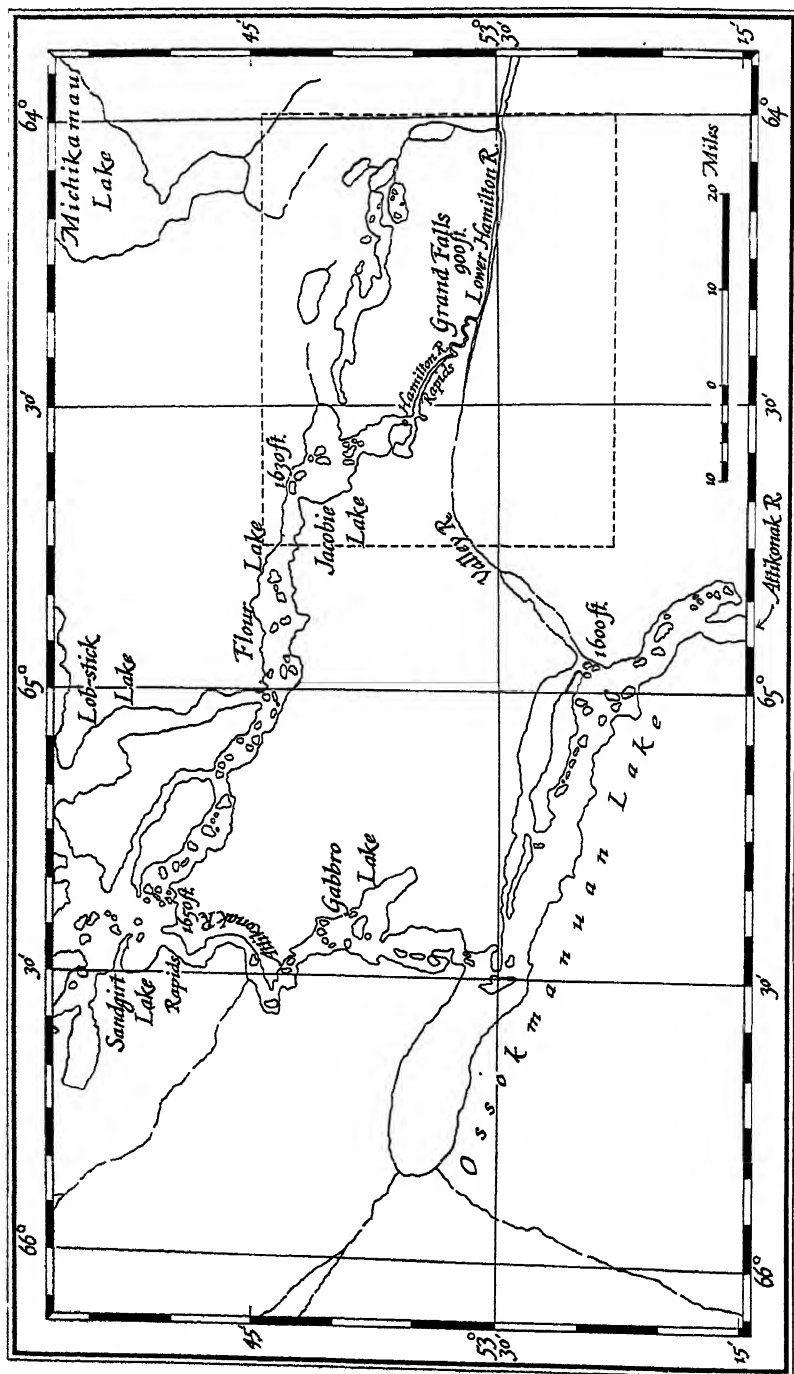
Grand Falls. Two white trappers from Northwest River Post, who had travelled almost to the height of land in winter, came with us as guides, and at the last minute we were joined by a Canadian prospector who hoped to find gold. In two canoes built especially for our expedition at Quebec, we carried a little over 1000 lbs. of provisions as well as the usual indispensable luggage.

Due to recent rainstorms, the river was much higher than our guides had ever seen it. But in spite of this obstacle we reached the long portage around Bowdoin Cañon and Grand Falls after seventeen days. This portage route, known as the Big Hill, leads 700 feet straight up the side of the valley in a distance of 450 yards. Then it continues along the Labrador plateau across twelve small lakes and as many carries for 25 miles to a broad lake expansion of the Hamilton River 8 miles above Grand Falls. In order to have an adequate view of Grand Falls, it is necessary to cross the river and walk downstream along the farther bank. If one is tempted not to carry the canoes over the long portage, but cut cross-country directly to Grand Falls at the nearer bank, the view is disappointing, as Mr. Bryant testifies.

As we drifted downstream with the current we found the lake-expansion gradually narrowing to a sharp turn, where it issued to the south-east in a wild unnavigable rapid. Here on the right bank permanent camp was established, while one of the men and I walked 5 miles downstream to the Falls at once. In this distance the river descends more than 200 feet, gaining speed for its final stupendous leap. Crowded between ever-narrowing walls, it slowly turns from south-east until at the Falls its direction is due south. This final angry plunge is worthy to rival any other display of raw power in North America.

Approaching the precipice with all the terrific energy gained by 5 miles of tempestuous rapids, the Hamilton forces itself into a trough of rock 50 yards wide. Against the eastern bank of this trough the stream is thrown 30 feet higher by centrifugal acceleration gained from a sharp bend immediately above. Then over the crest it rushes down a nearly perpendicular incline for 100 feet before leaving the wall altogether for a final descent of 200 feet. During this last drop the huge mass of water is torn to shreds, and a great deal of it escapes in the form of vapour that can be seen 20 miles away. From the crest of the incline to the water-level of the Cañon Mr. Bryant measured a vertical distance of 312 feet, and Mr. Low 302 feet. Mr. Low also estimated a minimum discharge of water of 50,000 cubic feet per second.

A nearly cylindrical basin 200 yards in diameter receives this great volume of water. In spite of the fact that it muffles the deep roar of the cataract, the sound can be heard 10 miles away on windless days. Thick mists and darkness hide the depths of this mysterious basin, but through occasional rifts one can see a surface of boiling whirlpools, and waves 30 feet high dashing against the perpendicular walls. From a grassy



1. Sketch-map of the Hamilton River basin, from the maps accompanying Mr. A. P. Low's report, *Geol. Surv. of Canada, Annual Report, Vol. 8, 1895*. The dotted line shows the area of Map 2

meadow one can best see the Falls diametrically opposite, but to reach this point one must defy a rare storm of rain.

From the basin Bowdoin Cañon issues due east at right angles to the river above the Falls, leading after 8 miles to the main river valley. We were impressed by the unusually good situation for a power-plant in the angle between the Falls and the Cañon. It would be a relatively simple matter to harness this cataract.

On comparing our observations with those of our predecessors, it seems that Grand Falls is cutting back rapidly and at a greater rate near the top than at the bottom. Not only do descriptions and old photographs lead to this supposition, but it is strengthened by the fact that in 1891 Mr. Bryant was able to drop a plumb line to the bottom of the Falls, whereas to-day it would be impossible to drop a line out beyond the sloping cliff. Furthermore, when Mr. Bryant saw my moving pictures in Philadelphia last year he noticed that the falls seemed to be more sloping than they had been at his visit thirty-five years before. However, such a change seems natural in a granite and gneiss cliff of uniform hardness, unlike a wall such as the one under Niagara where the lower strata, being the softer, have been more susceptible to erosion.

In making photographs, we were exceptionally fortunate in having not only bright sunlight but a strong easterly wind to carry off the vapour. Having accomplished this, we planned to look for the "Unknown River" and its rumoured waterfalls, and at the same time determine the function of Valley River.

Concerning the former, Mr. Low writes in his report the following paragraph under "Unknown Channels" (p. 139): "Two miles above (Disaster Rapid), at the angle of a small sharp bend, a large branch flows in from the west in a well-defined valley. Inquiries made among the Indians who had hunted about here failed to yield any information concerning this stream, and they were surprised to hear of its existence, as they all were without knowledge of any large stream between the main river and the Elizabeth River which enters Lake Winokapau. The only explanation about this unknown stream was that it must be a deep channel of the Valley River, and must leave that stream somewhere above the main forks; but the origin and existence of two deep, well-defined valleys such as these, forming an island, is anomalous, and could only be accounted for by the river splitting into two branches before it leaves the tableland."

Curiously, Mr. Low does not mention the possibility that Valley River need have no connection with the "unknown channel" whatsoever. Considering the fact that the volume of water emptying from the mouth of the channel is several times as great as that in Valley River, it would have been more reasonable to suppose that the "unknown channel" drained Lake Ossokmanuan wholly by itself and not as an anomalous auxiliary for Valley River. As for the source of the latter, there was no

reason to expect so small a stream to drain more than the immediate vicinity. With this theory to work upon, one of the guides accompanied me to explore the region for whatever evidence we could gather.

Before cutting cross-country we followed Bowdoin Cañon for several bends of its zigzag course. The Cañon always follows a line either east and west or south-east and north-west. Apparently these are the directions of two sets of fracture or cleavage planes in the rock which have helped to determine the course of the Cañon as the eroding water worked on the line of least resistance.

Another interesting fact was that the farther we progressed from the Falls the older the appearance of the Cañon became. Immediately below the basin the walls of Bowdoin Cañon are quite perpendicular, and in one place I had been able to lean out on an overhanging cliff to photograph the swirling waters 500 feet below. But as the Cañon approaches the main forks the cliffs become much more sloping and are well wooded. This fact led me to suppose that the Cañon had not been carved out by water acting in a horizontal plane, but by a cataract similar to the present Falls whose corroding action if not vertical worked at least at a steep angle.

Carrying a cinema camera and light rations for three days, we cut south-west from Bowdoin Cañon. At noon we reached the stream which is marked Valley River on Mr. Low's map. After climbing down the steep valley-sides to the water-level, we were relieved to find the stream divided by islands of drift into several channels, all of which were so shallow we had no difficulty wading across. Half a mile below, Bowdoin Cañon cut through the valley wall and vomited its great volume of seething waters. But though as far up and down from this junction as we could see the valley appeared the same width, depth, and age, the river which flowed by our feet was a mere drop in the bucket compared with the discharge of Bowdoin Cañon. Quite obviously we stood in a fossil valley—the old main valley of the Hamilton. Probably the glaciers had deposited so much *débris* farther upstream that the old waters had been dammed and diverted northward to carve out a new channel. Grand Falls and Bowdoin Cañon had been the result.

As we studied Mr. Low's map and looked upon this little stream at our feet, it seemed improbable that so small a volume of water as Valley River drained at present should be the full amount emptying from a lake so large as Ossokmanuan. To fulfil this function there must be another larger river farther south, and as we marched on to the south-west I felt confident it would prove to be the unknown tributary of the Hamilton.

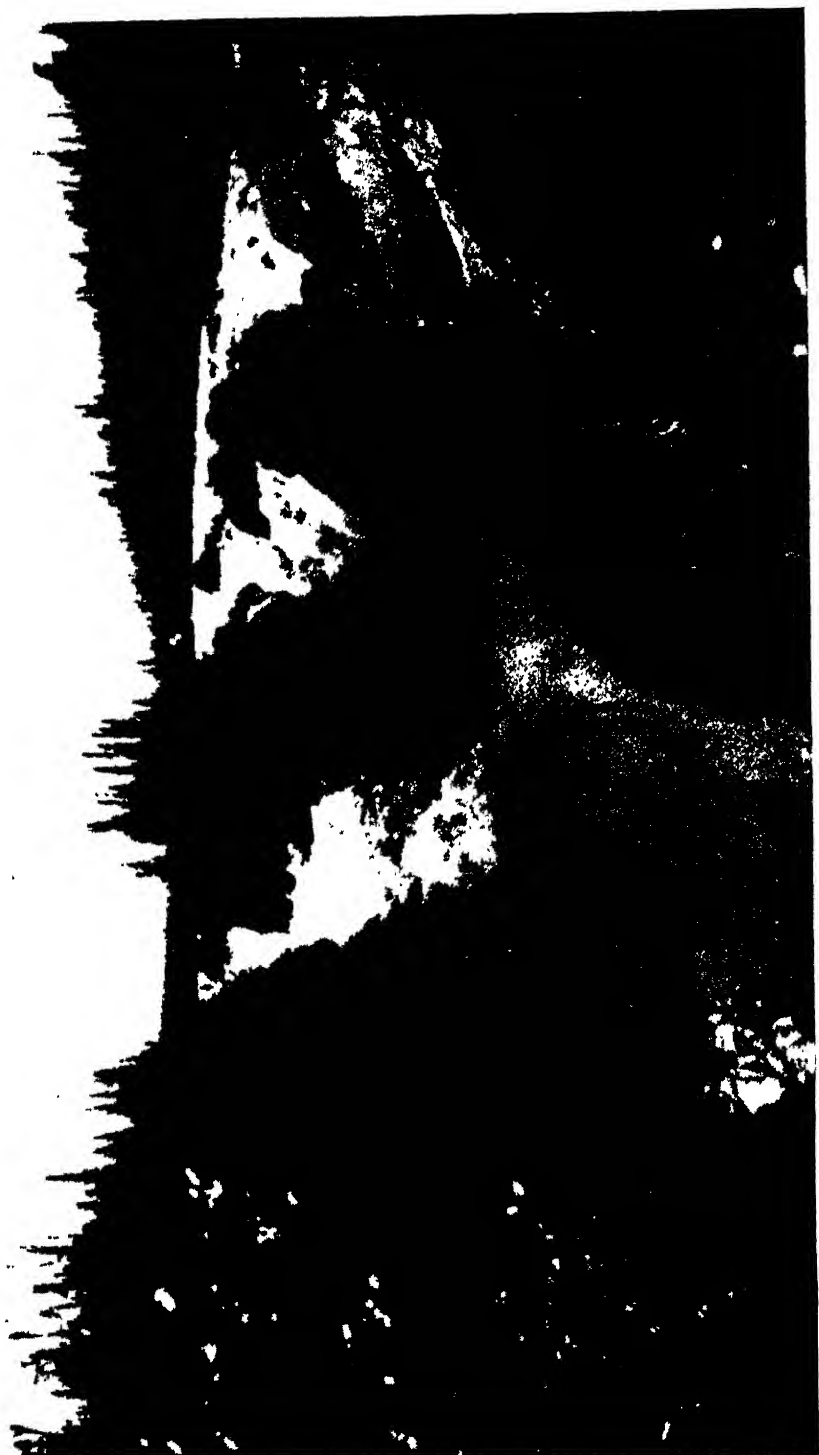
Upon the great peneplain of Labrador we stumbled through miles of spruce and pine forests. Towards evening a devastated area of burnt land had to be crossed, and our throats became so parched that the prospect of a river seemed more alluring than ever. But we came to the very edge of the unknown valley without hope or the least premonition



The Hamilton River 25 miles below the Grand Falls



The "Grenfell" River about 16 miles below the Falls



The "Yale Falls" on the "Grenfell River"

that it was there. Cut deep into the plateau, one could hardly have been aware of it until one had almost fallen in. Grateful for this sudden transformation from desolation to fertility, we tumbled down the steep green banks of pine, found a bed under the willows, and fell to sleep at once. We had found the stream about 12 miles above its junction with the Hamilton where Mr. Low had seen it in 1895. Since "Unknown River" was no longer an appropriate name, and as far as we knew the Indians had never christened it, we proposed to call this tributary "Grenfell River."

Following upstream in search of the rumoured falls, we found a continual stretch of heavy rapids, so rough as to be quite impractical as a route; this is apparently the reason why the river is so little known by the Indians. In places the gorge became so narrow that we were forced to follow the valley on the plateau level. Late in the afternoon two distinct clouds of vapour showed far to the westward. As we approached, it became apparent that Grenfell River was split by a high island into two channels with a fall on each. The farther one we never saw, as it was impossible to cross the nearer branch of the river to the island. However, since both channels discharged nearly the same amount of water, and both falls had at a distance been marked by an equal volume of vapour, it seemed probable that they were approximately the same size. But when mist rose over the summit of the island, it was aggravating to have this hidden twin so near and yet be unable to see it. However, we soon became absorbed in observations of the nearer cataract and channel.*

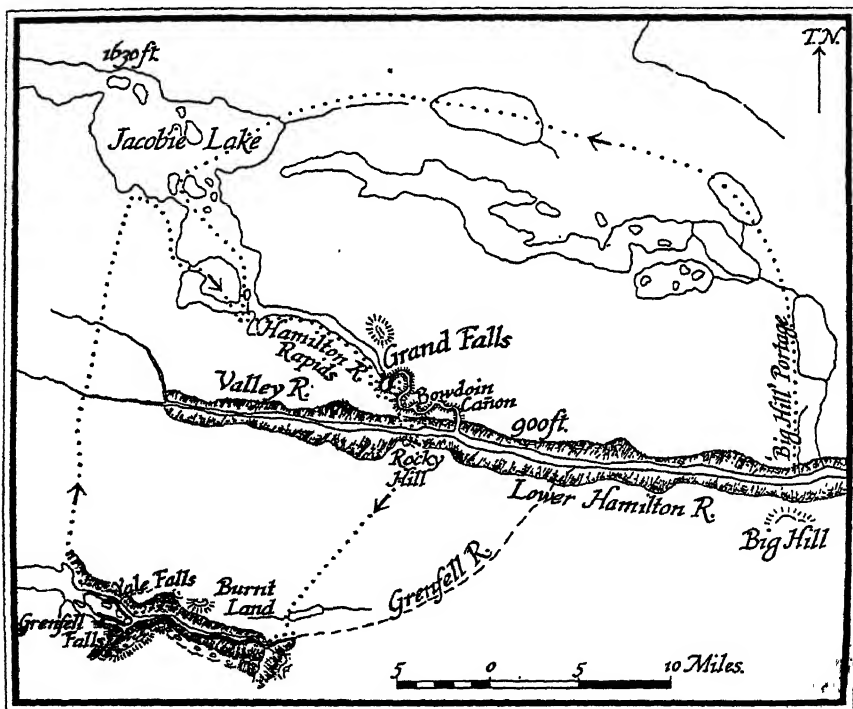
Like the Upper Hamilton, Grenfell River apparently flows through the plateau country from Lake Ossokmanuan in a series of wide expansions. Though we could not explore these because of exhausted provisions and threatening forest fires, as far upstream as the eye could follow the river flowed tranquilly between low shores. However, nearing the two falls it contracts, and after its division by the north-western end of the island the stream in both branches gathers speed and energy. The nearer one soon breaks into heavy rapids, and is again divided into two equal chutes by a long narrow rock in midstream. At the lower end of this rock the contents of both chutes is emptied over a nearly vertical incline. Halfway down the two roaring arms of water join forces, and in a single white mass thunder to the bottom 120 feet below. Because of the striking suggestion of a huge letter Y, we have proposed to give this falls the name of Yale.

Below the falls the river rushed S. 20° E. between perpendicular cliffs. But after a short distance ancient landslides have broken down the northern wall and increased the width of the channel. However, the

* Mr. Thomas's photographs were apparently taken from the right or south bank of the river, and shows the "Grenfell Fall," as he proposed to name it, and the cañon below, with a more distant view of the vapour rising from both falls, on either side of the island. These photographs confirm the configuration of island and falls shown on Mr. Frissell's sketch-map.—ED. G. J.

river soon resumes its cañon-like aspect as it crowds between two solid walls of granite not more than 30 yards from base to base. This portal is an ancient barrier of the valley. On its southern side it is smoothly polished by the old cataract which, gradually cutting a gap through the granite, formed the present gorge. From here the cañon runs due south for nearly a mile, after which it is joined by the farther branch flowing in from the west.

Having made a rough survey of this region, we decided to get back to our main camp on the Hamilton as quickly as possible. Not only did the forest fires seem nearer, but we were weak with hunger. Upon the



2. Sketch-map on twice the scale of 1 to show the results of Mr. Frissell's exploration

return march we crossed two small brooks near their sources. Farther east they no doubt emptied into Valley River, but at this point there remained no evidence of the ancient valley itself. It had been completely buried by the *débris* of glaciers. Here was final proof that Valley River did not drain Lake Ossokmanuan.

To complete our survey of Grenfell River, it was necessary to follow the expansions from Lake Ossokmanuan downstream to Yale Falls. From our permanent camp, Lake Ossokmanuan could be reached by following the Upper Hamilton in the canoes to Sandgirt Lake and striking

off from there by the Attikonak Branch. Furthermore, this route would afford opportunity to solve still another drainage mystery.

Which way does the Attikonak Branch of the Upper Hamilton flow? From Ossokmanuan to Sandgirt or Sandgirt to Ossokmanuan? In answer to this important question, Mr. Low's map contradicts his report, for though the former gives the altitude of Sandgirt Lake as higher than Ossokmanuan, we read in the Report (p. 163) that "the Attikonak Branch flows *into* Sandgirt Lake on its south side." Though it is hard to understand how Mr. Low could have incorrectly reported so obvious a matter, we cannot believe that the drainage is uphill. Personally, I accept the contradictory evidence given on his map, viz. that the current on the Attikonak runs south from Sandgirt to Ossokmanuan. I am encouraged in this belief by a trapper who says that he distinctly remembers this is the case.*

If so, then Sandgirt Lake is a junction where the river may follow either of two channels: the one by Bowdoin Cañon and Grand Falls, the other by the Attikonak to Lake Ossokmanuan and thence back to the Lower Hamilton *via* Grenfell River. I mention this because of the possibility that the Attikonak Branch may be slowly capturing the waters of the other channel. Upon a plateau of wide shallow lakes where no permanent drainage has become established, many startling changes

* The following notes are extracted from the report of Mr. A. P. Low, pp. 139, 147, 163-5:

"Above the mouth of Bowdoin Cañon the main valley continues more than 10 miles and then bends slightly north: river in it has moderate current and about one-quarter volume of water of the 'other river.' It rises in Lake Ossokmanuan 30 miles westward, which also discharges by another outlet into the main Hamilton River.

"At Sandgirt Lake the Hamilton river divides into two branches, the larger or Ashuanipi branch flowing in from the north-west, and the Attikonak branch from the south.

"The northern channel of the Attikonak branch flows into Sandgirt Lake on its south side. . . . Lake Ossokmanuan from its northern outlet trends directly south for 8 miles. . . . On the north side near the head of the upper island a branch called Valley River flows out. This stream is somewhat larger than the northern outlet, and constitutes the river which at present flows down the Hamilton river valley above its junction with Bowdoin Cañon. . . . The guide had never visited the river below the chutes, but had heard that there was a high fall on it, some 15 or 20 miles above the place at which the main body of the Hamilton river enters the valley at the mouth of Bowdoin Cañon."

The direction of flow is implied several times, and it seems scarcely possible to doubt that Lake Ossokmanuan flows into Sandgirt Lake, in spite of the heights marked on Mr. Low's map, which make the latter 50 feet higher than the former. On the contrary, the map published in the *Journal* for June 1895 to illustrate a paper read to the Society by Mr. Low, makes the former 30 feet higher than the latter, from Mr. Low's aneroid heights, which at that time were only partly reduced. It seems probable that the 1600 feet on the Canadian map is a mistake.

On the other hand, it seems clear from Mr. V. Frissell's observations that the eastern outlet of Lake Ossokmanuan is not to the Valley river, and that the local information collected by Mr. Low, while correct as to the existence of falls, was wrong in the connections of the river on which they lie. The questions raised by Mr. Frissell are evidently of great importance in any schemes for hydro-electric development.—ED. G. F.

are likely to occur. Even the Grand Falls may eventually run dry with its burden of waters unloaded upon the Attikonak and Grenfell Rivers!

When companies begin to develop the water-power of this region, they should investigate this possibility. They may even find it practicable to regulate the ratio of discharge between these two channels by building locks at Sandgirt Lake.

But our plans to investigate the drainage and explore the lakes of Grenfell River had suddenly to be abandoned. One evening the ominous red glow in the sky kindled alarmingly, and when next morning we saw heavy smoke in three directions we did not hesitate what to do. Having dashed over the Big Hill Portage, we launched our canoes once more on the swift broad back of the Lower Hamilton, and after five days reached the coast.

We have used on the sketch-map and in the paper the names Grenfell River and Yale Falls proposed by the author, without committing ourselves to their acceptability. It would seem that what is here called the Grenfell River should be considered the main branch of the Attikonak.

Since this article was in type, the Judicial Committee of the Privy Council have given judgment in the Labrador Boundary Case, and have awarded to Newfoundland the whole of the highly important and valuable region described by Mr. Frissell.
—ED. G. F.

THE GEOGRAPHICAL SOCIETY OF GEORGIA

WE had recently the pleasure of a visit from Professor George Nikoladze, of the University of Tiflis, who gave us welcome news of the recent foundation in Tiflis of the Georgian Geographical Society, which has in the past few years entered upon a career of activity which promises well for the future of geography in the Caucasus. The following account of the new Society, and of its expedition to the summit of Elbrus and into Svanetia and Abkhazia in 1925, is given us by Professor Nikoladze, to whom we are indebted also for permission to copy for the collection of our Society some of his very interesting photographs.

The Society was officially inaugurated in January 1924, its first chairman being the Georgian Minister of Public Education, M. D. Kandelaki, with whom several professors of Tiflis University are associated as members of the Board. The object of the Society is the thorough study of Georgia and of the Caucasus, and the spread of geographical knowledge: for this purpose it is organized in several sections, amongst others anthropological, educational, and geophysical. It has also a cartographical department, which, as well as forming a collection, has issued several school maps in Georgian, and a map of Georgia on the scale of 5 km. to 1 inch, a revision of the former 5-verst map.

A brief survey of some of the activities of the Society during its first three years will illustrate its scope. In 1923, in co-operation with the Georgian Observatory, an expedition was made to the summit of

Kazbek, the first ascent since 1913. Magnetic observations were made on the way, the northern glaciers and slopes of Kazbek were surveyed topographically, and meteorological records obtained. Two years later this ascent was repeated, and a new meteorological screen was built on the summit. The party remained a week on the snowfields to make meteorological observations. A similar expedition was made in September 1926. Other branches have been equally active: in 1924 a party of naturalists visited the Ossetia-Racha region, including the valleys of the Kvirila, Ardon, and Tseyra, and the Tseyra glacier. The Racha region was later visited by geologists, who did some mapping and revision in the neighbourhood of Oni. A mineralogical expedition was also sent in 1926 to examine the valley of the Dzirula, when a large collection was obtained for the University, and beds of graphite located. Two medical parties have also been at work in Svanetia, investigating the spread of goitre and other diseases. Another branch of the Society's work is the selection and training of guides, to enable them to conduct parties of school-children from Tiflis through the surrounding country.

The most important expedition of the Society, that to the Elbrus district, undertaken in July-September 1925, merits a more detailed account.

THE EXPEDITION OF THE GEOGRAPHICAL SOCIETY OF GEORGIA TO THE SUMMIT OF ELBRUS AND INTO SVANETIA AND ABKHAZIA IN 1925

Elbrus (5630 metres) is the highest mountain in the Caucasus. It is situated on the north of the principal mountain range of the Caucasus, which, as it is well known, serves as a dividing line between Asia and Europe. Elbrus, wholly in the European part of the Caucasus, is therefore indisputably also the most elevated mountain in Europe. Its eastern summit (5593 metres) was reached first by Mr. Douglas W. Freshfield on 31 July 1868. After Mr. Freshfield's, many more ascents to the peaks of Elbrus have been carried out, altogether about twenty. But between 1913 and 1925 no ascents were made. All the guides who used to direct the climbing of this mountain had by the end of this period disappeared, and the hut which had been built on the rock Krugozor, at an elevation of 3100 metres between the glaciers Great and Small Azau, by the Society of Caucasian Mountaineers, and which served before the war as a shelter for climbers on Elbrus, became a heap of ruins.

The expedition was sent by the Geographical Society of Georgia under the direction of Mr. Nikoladze. It consisted of seventeen men and ten women, all members of the Society. The expedition lasted from 26 July to 19 September 1925. It travelled by difficult mountain foot-paths more than 700 kilometres, and collected on the way numerous and valuable materials. Mt. Elbrus was successfully climbed on August 12, and it is worth noticing that it was the first time that a party

consisting of so many climbers (fourteen men and five women) had ascended, and also that it was the first ascent accomplished by women.

The expedition was financed partly by contributions of its members, partly by various Georgian institutions, but chiefly by the Government of Georgia, which granted to the Geographical Society for the purposes of this expedition 2000 roubles. However, the whole cost of the expedition, thanks to great economy, did not amount to more than 4000 roubles, including all the equipment and two months' travelling expenses.

Having gone by railway from Tiflis to Kislovodsk, the expedition started thence on foot on August 2. It passed the Circassian village Karmovo and the Balkar village Gundelen, and on August 4 entered the valley of the Baksan river. It stopped for one day in the village of Urusbievo; and then continuing its route it reached on August 7 the foot of the glacier Azau, which lies upon the southern slope of Elbrus and gives rise to the Baksan river. Here our expedition was met by the expedition of the Caucasian Mountain Society of Pyatigorsk, which had for its purpose the study of the glaciers in the basin of the Baksan river and an ascent of Elbrus. This Pyatigorsk expedition was under the direction of a well-known Russian alpinist Frolov, who had made the ascent in 1911. Twenty members of the Georgian Geographical Society and seven members of the Caucasian Mountain Society started together at 6 p.m. on August 7. One night was passed near the ruins of the hut "Krugozor" (3100 metres), and the second night on the rocks known as "the Shelter of the eleven" (4200 metres).

At six in the morning of August 9 they renewed their ascent, hoping to reach the summit that day. However the weather, which till then had continued very favourable, changed altogether for the worse. About noon, when both the expeditions reached an elevation of about 5000 metres, such a severe snowstorm began that further movements, especially of so many people, became risky, and they were compelled to retreat. The expedition of the Georgian Geographical Society, which was provided with tents and could receive provisions from the camp at the foot of the Azau glacier where some members of the expedition were left, retreated to the rock "Shelter of the eleven," and remained there awaiting a change of weather; but the expedition from Pyatigorsk, which was not so well equipped, had to descend altogether and returned to Kislovodsk without having reached the summit.

The weather improved on August 12, when the expedition set out at 5.30 a.m. and reached the eastern summit at noon, thus having spent six and a half hours on a climb which usually requires eight or nine hours. On its way up to the summit the members of the expedition could enjoy the marvellous view of the whole Caucasian mountain range, except during the ascent of the last 100 to 150 metres, when thick clouds obscured the view. The expedition could stay on the summit only about fifteen minutes on account of a strong wind and clouds.

Descending by the same route, the expedition crossed the main range by the Donguzorun Pass (3200 metres) on August 18, and entered the region of Svanetia by the valley of the Nakra river. Thence passing through the village of Becho it reached the foot of Ushba (4700 metres), of all the Caucasian peaks the most difficult to climb, and carried out an investigation of it. To accomplish this the expedition ascended the south-eastern slope of the mountain, reaching by the glacier Guli a height of 3400 metres.

Passing through the village of Mestiya the expedition reached the Lekzir glacier, the biggest in Transcaucasia. Here the expedition remained three days. Afterwards the expedition visited many other glaciers in Svanetia which feed the river Ingur and are on the southern slopes of the central Caucasian range. It also visited the villages lying in this part of Svanetia, as Kal, Ushkul Adishi, Mulakh, where, among others, valuable archæological and ethnographical materials have been collected. In the village Kal the expedition on September 2 divided into two parts: one crossing by the Latpar Pass travelled through Lower (Dadian's) Svanetia and reached Kutais, whence it returned to Tiflis by railway; the other part went back down the valley of the river Ingur, entered the valley of the river Nenskrira, where it visited the recently discovered remains of metallurgic works of the time of Alexander the Great. These remains are situated in the valley of the Nenskrira (which is a tributary of the Ingur, 20 kilometres above Chuber). The expedition acquired there two beautifully preserved golden coins, one of Alexander the Great and the other of King Lysimachus, dug up by a peasant. On September 13 the expedition left Chuber and, having crossed the Khida Pass, entered the valley of the Seken river in Abkhazia, where it ascertained that this valley, which formerly was quite a desert, is now thickly populated by settlers from Svanetia. On September 15 the expedition, having passed down the valley of the Kodor and through the village Tsebelde, reached the coast of the Black Sea near Sukhum-Kale, and thus finished its arduous travels on foot, which had lasted six weeks.

Note.—The spelling of names is from the Russian, transliterated by the system of the P.C.G.N. There are some discrepancies with the spelling used by Professor Nikoladze in his original manuscript, perhaps arising from a difference between phonetic Georgian and Georgian transliterated into English through Russian. But the forms here used differ little from those of the map illustrating Mr. Freshfield's book, *Exploration of the Caucasus*, in which the greater part of the above route is described. The P.C.G.N. will be glad to receive from the Georgian Society maps or lists of names in Georgian for an ultimate revision of our spelling of Caucasian names in English.—Ed. G. F.

AN ADVENTURE TO KANGCHENJUNGA

Capt. Hugh Boustead, Gordon Highlanders, att. Sudan
Camel Corps

IT is a far cry from the Sudan Camel Corps, amongst the rolling sands of Kordofan, to the glaciers and mountains that lie around Kangchenjunga. In the spring of 1926, when leave made this journey possible, I found myself in Darjeeling fitting out a party of Mount Everest porters to endeavour to reach a pass that lies to the west of the peak of Simvu, and east of Kangchenjunga.

The preparations entailed four days' hard work in Darjeeling, buying stores and warm clothes, goggles, boots, puttees, etc., for the porters. Without the help of Mr. Shebbeare, the Conservator of the Bengal Forests, and a member of the last Mount Everest Expedition, I do not think we should have started for a week. Besides lending me much alpine kit, he kindly vetted the Mount Everest porters whom he knew personally, and chose the best five from among them and a Sirdar Nur Sung who had been on two of the expeditions. We left for the mountains fully equipped the day that Mr. Shebbeare left for England on leave.

By his advice we took the route along the Phallut Ridge, which gave one time to acquire a better colloquial knowledge of the language, to get on terms with the porters, and to become gradually acclimatized to the increasing height.

The journey by Phallut and Dentam up to Dzongri and the snows is well described in Col. Buchanan's Sikkim Tours. We met the greater part of the kit at Yoksam, whence it had gone by the direct route through Chakung. From Yoksam the track leads through dense jungle to Dzongri, where we made a dump of stores for the return journey.

We pushed on next day up the Parek Chu by Olatang, where the last firewood grows, to the camp of Chematang below Pandim, which had towered before us all the way up this valley. We had left Darjeeling on April 23, and making ordinary marches by Phallut, reached Chematang on May 4. During this period I was principally occupied in learning Nepalese, of which I had by this time acquired a vocabulary of some 300 or 400 words, and in getting to know the porters.

On the morning of May 5 we left the camp at Chematang for the Goycha La and the heart of the mountains. Sirdar Nur Sung and one porter stayed to look after the coolies and the surplus kit that we could not carry on the glaciers. We had equipped only the seven Mount Everest porters for the mountains. Till now we had been on the trodden route.

The Zemu gap that we hoped to reach lies at the south-west end of the Zemu glacier and is a pass of 19,300 feet, connecting the Zemu and the Tongshyong glaciers. I believe that no one had previously entered the

Tongshyong glacier.* Dr. Kellas, during one of his many journeys in the Himalaya, traversed the Zemu glacier to where the icefall ends abruptly above the Tongshyong, and from there he could have looked down the Tongshyong valley to the south-east. But it was not known whether the crossing of this pass from the Tongshyong would be a matter of great difficulty, and whether the pass could be crossed on the Simvu or Kangchenjunga side of the icefall.

On May 8 we left camp at Chematang at 7.45 a.m. and arrived on the Goycha La at about 9.15. A wind-driven mist greeted us as we crossed this pass at 18,000 feet and snow fell. It obscured both the view of the Zemu Gap that we should have had in clear weather, and our line of descent into the Talung glacier.

Earlier I had taken bearings on the map, and we pressed on, marching by compass slowly over the pass down a steep descent to the Talung glacier. The snow was very deep and soft, and we went slowly with heavy loads, only able to see a few feet in front.

We camped on a shoulder at 11 a.m. above the Talung glacier bed. Occasionally through snow blown swiftly past, a black rock wall, the south-east shoulder of Kangchenjunga, on the far side of the Talung glacier, loomed large and near. It looked as if we were camped right beneath it. About ten a constant echo of avalanches filled the mountain gorges. Until we re-crossed the Goycha La they remained a daily danger.

All that night snow fell in a driving gale, threatening the tent ropes, and thunder echoed through the hills. With the day the storm had died, but snow was still falling. I had long pored over the map and considered compass bearings. When at 8.30 a.m. on May 6 the snow had not abated, I decided to move. The place to avoid appeared to be the far side of the Talung. Again by noon the roar of avalanches of new snow falling from the steep mountain wall opposite was filling the valley.

There was marked on the map a chu running from near the Goycha La into the Talung glacier, and this by great good fortune we struck, and steering very slowly through snow, now thigh-deep, we made for the centre of the glacial moraine. Here we should be clear of avalanches, and here, according to the map, by going south-east we should eventually come to the end of that mountain wall where the Tongshyong glacier pours into the Talung. At the head of the Tongshyong is the Zemu Gap. At one period during that day I realized the dangers our position held. In avoiding that threatening shoulder opposite, we had moved below one of Pandim's north-eastern glaciers. An avalanche here, after all this newly fallen snow, would submerge the whole party. On our return

* In this Captain Boustead was mistaken. In April 1925 Mr. N. A. Tombazi had followed much the same route over the Guicha La and up the right lateral moraine of the Tongshyong glacier; but crossed about halfway up to the left-hand moraine, whence he reached the Zemu Gap, but was unable to go farther. See *Account of a Photographic Expedition to the Southern Glaciers of Kangchenjunga* by N. A. Tombazi, Bombay, 1925, reviewed in *G. J.*, Jan. 1926, 67, 74.

journey the hanging icefall broke away at this very place, and crashed into the valley down the slope we had previously crossed.



Sketch-map from the map in Mr. Freshfield's paper "Round Kangchenjunga," showing Captain Boustead's route. Mr. Tombazi's route diverges to the eastern lateral moraine of the Tongshyong Glacier, and reaches the Zemu Gap but does not cross it

About 1.0 a momentary lift in the snow-cloud showed us to be on a safe part of the glacier bed. We camped, and all that night of May 6

it blew, and the snow fell. We were soaked through, and having seen nothing clearly from leaving the Goycha La were uncertain of our position. The men were very cold. Sixty pounds of stores, when you are wading thigh-deep in snow on a mountain-side, is a heavy load, and they were weary. But time and rations were limited. We did not know how long it would take to reach the head of the Tongshyong, and could not afford to wait snow-bound for days.

Morning showed a new world. On both sides above us towered the mountains, wrought in a mantle of freshly fallen snow. It was 4 a.m. May 7, and the sun was just touching the topmost peaks. I left the men to make tea at once, and went down the valley to where I thought I could see the Tongshyong glacier stream pouring into our moraine. It was there ahead. There was no mistaking it. But again the amazing deceptiveness of these distances struck me.

At 6 o'clock I was back to find no tea, as the Primus had jibbed. This was exasperating, as the danger of avalanches was great with the new snow and a glowing sun rising over the mountains. At 7.15 we eventually got away. The porters were cold and slow in moving after a wretched night. This was nearly our undoing.

It was an hour's march to the foot of the Tongshyong glacier stream. Here is a peak of marked shape (numbered 19,050 feet, no name), which points like an index finger to the sky. Below we left a three days' dump of rations, and then on this brilliant sunlit morning started for the pass. Of the entrance to that glacier stream I had misgivings from the start, when sighting it alone in the first light of dawn. But it looked as if we might hope for better things inside. The entrance was overhanging cliffs, and above on the north-east side towered the range that runs down from Mount Simvu to Peak 19,050 feet. We should have gone up at 4 o'clock had we known our position and not been delayed.

The overhanging cliffs near the entrance were dropping stones as we went up, few but dangerous. Higher, things got worse. Loose cliffs on both sides looked as if they might fall in at any moment, and barrages of stones were rolling into the chu. For morale's sake I kept the party together, though it were better to be killed singly than all together.

As we joined the glacier avalanches were pouring down from the heights on the left bank, and over the moraine which runs like a steep cliff along the side.

Two of the men had been in the first Mount Everest fatality when seven porters were killed by an avalanche, and were scared out of their lives. And then a thick mist rolled up the valley and obscured everything. All around was the rushing sound of snow and stones. I set the men down under the largest boulder we stumbled on, and went slowly up through the mist.

The right bank of the Tongshyong glacier as I moved towards it gradually loomed up a steep wall of rock. Above this wall of rock there

appeared to be no towering hillside cascading snow and stones, as was happening across the moraine. Once under the shoulder of this wall, with the tents up and making tea, the party could smile once more. We had had four rather nerve-shaking hours, though we must have come up that chu in record time. It was now 1 p.m. I had a sketch of the Zemu Gap with me, given me by "A" in Calcutta, and made by a previous expedition. The sketch shows the ice pinnacles of the Zemu glacier hanging down over a dark rock cliff, the head of the Tongshyong valley; and on the east of the Zemu pinnacle there rises the towering shape of Simvu. There is a couloir running up to an ice slope below Simvu and thence on to the Zemu glacier. Here "A" had made a mark as a possible crossing of the pass. The mist cleared later, and it was all there. But down this couloir, where we might ascend to the pass, an avalanche of snow was pouring into the Tongshyong valley.

I left the porters and went to look at the west side of the pass hidden behind our rock shoulder. The last rays were falling on Simvu peak. A couloir on the west side looked steep, but safer from avalanches.

It was 3 a.m. on May 8 when Angpenba, Doctor Somervell's bearer on the Mount Everest Expedition (a Nepalese lad, bold and quite tireless), came with me up the couloir that runs up to the west of the Zemu gap. We had slept the night under the rock shoulder, and left the other porters sleeping. The couloir was steep, and we were hurrying and rather breathless, fearing the coming of the sun. Above we could see a snow ridge running up to the pass above the Zemu glacier. It was 4 o'clock as we reached the ridge, and the rocky peaks above the Zemu on our side of the pass were glowing in the first rays. On the far horizon over the centre of the Zemu Gap and behind Green lake, where Kellas went, some peak was alight (numbered but unnamed). We turned towards the south; Pandim was fully lighted now, a mass of white and blue, hanging in ice-ribs, with its splendid dome over all. And so we moved, breathless to the crest of the pass (19,300 feet), and there opened before our eyes the fluted blue ice pinnacles of Siniolchum in long serried ridges against the perfect blue of the morning sky.

She is written of as the Jungfrau of the Himalaya, the Queen of mountain beauty. She towered in morning splendour over the level mass of the Zemu glacier ice. We descended to the glacier across the pass, and then reluctantly returned, for the morning sun was already softening snow. Where we had trodden in the ascent to the pass on a surface as hard as ice, we were now going through knee-deep in the snow. As we reached the tents clouds were rolling up the valley from the south-east, and presently at 9 a.m. the hills were echoing with the sound of falling stones. Snow fell that day and late into the night. On the morrow we were faced with the descent through the Tongshyong Valley; there must be no delay, and orders were given to start at 3 a.m.

Our wildest fears during the ascent had hardly pictured the scene of

destruction and *débris* which we were to cross. Our tracks of two days previously were covered in many cases by the hillsides having crashed into the valley and filled up the racing chu. There was not 50 yards of our going uncrossed by some enormous slip. We looked fearfully through the half-light at the hanging walls above us, bound at the moment by the night frost.

In a short time the first warm rays would loosen them, and perhaps even then some trickle of water from a mountain stream might send us to destruction beneath these walls. We raced down the chu. In forty minutes we had reached the foot of that valley, and arrived breathless and thankful in the Talung glacier. And no stones fell during our passage.

The Talung even in these two days presented a very different scene, so quickly does the May sun change the face of the Himalayas. Where we had walked through snow thigh-deep, the boulders of the glacial moraine were in many places now uncovered. We headed back towards the Goycha La.

I should mention that above the Talung glacier bed on the north side of the Goycha La, we found firewood growing. Had we known of this before, we could have made our last camp there instead of at Chematang, and left the Sirdar Nur Sung there. After leaving Chematang we had relied entirely on two Primus stoves and some cookers.

The entrance to the Tongshyong glacier may be less dangerous at other times of the year, but should always be made in the very early hours, as it is a three hours' climb before one is free of the danger of avalanches and falling rocks. Another party, knowing that the Zemu Gap can be traversed on the west side of the ice-fall, could cross over on to the Zemu glacier, returning by Lachen. In clear weather a day's march could take one from Chematang to the junction of the Talung and Tongshyong glaciers, and another day's march over the Zemu Gap.

This was my first experience of snow and ice in the Himalayas, and made me fully realize the importance of moving early. The snow was soft by 9 o'clock a.m. nearly every day and the mountains obscured in mist by 10 a.m., so that the day's journey had to be made between 3.30 a.m. and 9.30 a.m.

Returning from Semvu I made a reconnaissance of Pandim from the north side in the hope of being able to attempt to climb it from the Talung. I ascended a very steep couloir with Angpenba to about 20,000 feet, but returned, as we were faced by the precipitous ice-fall below Pandim's north-eastern glaciers.

We then pushed on to the Goycha La and prospected the mountain from there, attempting to form a high camp on the ridge that runs north-west down to the Goycha La and work up the same ridge, which from every side appears to offer the greatest hope of an ascent. It was then the monsoon broke; clouds and heavy snowstorms made further move-

ment impossible. The bad weather held on, and we were forced to abandon further attempts. This was May 12. From May 4 till the 12th we had three fine clear mornings till 9.30 a.m., and during the rest of the time the snow fell incessantly and thick mists obscured the mountains. The snow conditions made the going terribly tedious, and without at least three consecutive days' fine weather Pandim would have been impossible, whatever the actual difficulties of climbing. Making forced double marches back to Darjeeling by the short route through Chakung, we arrived on May 18. The monsoon had set in without mistake, as the mountains were obscured and rain fell every day.

As regards expenses, the whole cost of food, portorage, pay, and equipment for the five Everest porters, Sirdar and cook, for thirty-two days away from Darjeeling, with the extra coolies required from Darjeeling to the snow-line, amounted to Rs.1200, or about £90.

Mr. Shebbeare, who gave me such great assistance before leaving Darjeeling, has established a sort of depôt in his house of Whympertents, cooking-pots, alpine rope, and alpine cookers for mountain expeditions towards Kangchenjunga. This depôt and his advice proved invaluable. It is advisable to take sufficient ice-axes for all the porters to Darjeeling.

THE TWO-HUNDREDTH ANNIVERSARY OF THE BIRTH OF GENERAL ROY

Colonel Sir Charles Close, K.B.E., F.R.S.

WILLIAM ROY may be looked upon as the real founder of the Ordnance Survey, though he did not live to see its official establishment. It was due to his persistence and energy that the idea of a National Survey Department took shape, and he was much concerned with two undertakings which carried in them the germ of the future development of the Survey. In 1747 he served as a subordinate in the Quartermaster-General's Department under Lieut.-General Watson, the Deputy Q.M.G. In Roy's words, "This officer, being himself an Engineer, active and indefatigable, a zealous promoter of every useful undertaking, and the warm and steady friend of the industrious, first conceived the idea of making a map of the Highlands. As Assistant Quartermaster, it fell to my lot to begin, and afterwards to have a considerable share in, the execution of that map." The map was "a magnificent military sketch," on the scale of 1000 yards to the inch, and it was eventually extended to cover the whole of the mainland of Scotland. Work on this map was stopped on the outbreak of war in 1755.

Then comes a long interval, during which Roy was unable to do much towards the furtherance of his favourite project of a National Survey.

We find him on reconnaissances in 1756, in the Rochfort expedition of 1757, at the battle of Minden, which was fought on 1 August 1759; D.Q.M.G. in Germany 1760-63; and in 1765 Surveyor-General of Work and Engineer for making and directing Military Survey in Great Britain. This latter post he retained until his death. In the 'seventies he was very busy with horizontal observations with his quadrant, and with experiments on the use of barometers for determining heights.

At the end of 1783 Cassini de Thury proposed that the observatories of Greenwich and Paris should be connected by a chain of triangles. Cassini's memorandum was referred by the British Government to the Royal Society, and the upshot of it all was that Roy measured a base on Hounslow Heath, somewhat more than 5 miles long, in August 1784. From this base, after nearly three years' delay, caused by Ramsden's dilatoriness in making the 3-foot theodolite (the father of all accurate theodolites), a chain of triangulation was extended which connected the two observatories. This work was finished in 1788. Roy wrote just before he died, in July 1790, that he could not help "considering it as being incumbent on him to recommend that the trigonometrical operation, so successfully begun, should certainly be continued, and gradually extended over the whole island. . . . The honour of the nation is concerned in having at least as good a map of this as there is of any other country." He also strongly urged that the terminal points of the base should be protected and preserved.

In his time these terminal points were marked by wooden pipes. When Mudge re-measured the base in 1791, he marked the ends by guns, fixed vertically in the soil, muzzles upward. These guns still remain in position.

A year or two ago it was realized that the two-hundredth anniversary of Roy's birth was approaching. Actually Roy was born on 4 May 1726, at Milton Head in Carlisle parish, Lanarkshire. It was thought that if the occasion was to be commemorated, no better way could be found than by protecting the terminal points of his base on Hounslow Heath by such precautions as might suggest themselves, and by affixing a suitable tablet to each gun. The Director-General of the Ordnance Survey identified himself with the scheme and worked out the details, and the Treasury permitted the necessary small expenditure to be defrayed out of the Ordnance Survey vote. Circumstances prevented the work being finished in 1926, but everything was ready early in 1927, and the Astronomer Royal, Sir Frank Dyson, representing the Royal Society, unveiled the tablet on the south-eastern gun on 22 February 1927, in the presence of representatives of the Ordnance Survey, Board of Agriculture, Survey of India, G.S.G.S., R.G.S., the parish of Carlisle, and the Trustees of the Hampton Charities.

Two memorial plates have been fixed, one on each of the terminals, which are guns buried vertically in the ground. They are identical,

except that one bears the words "N.W. terminal," the other "S.E. terminal." The N.W. terminal is in a field known as King's Arbour, 4 miles west of Hounslow. The site of this terminal is Crown Property. The memorial unveiled was that on the S.E. terminal at Hampton Hill. This terminal is situated on land which is now the property of the Trustees of the Hampton Parochial Charities. A small fence has been erected round this terminal, with the permission of the Trustees. The plates are inscribed as follows :

THIS TABLET WAS AFFIXED IN 1926 TO COMMEMORATE THE
200TH ANNIVERSARY OF THE BIRTH OF
MAJOR-GENERAL WILLIAM ROY, F.R.S.

BORN 4TH MAY, 1726—DIED 1ST JULY, 1790

He conceived the idea of carrying out the triangulation of this country and of constructing a complete and accurate map, and thereby laid the foundation of the ORDNANCE SURVEY. This gun marks the S.E. terminal of the base which was measured in 1784, under the supervision of General Roy, as part of the operations for determining the relative positions of the Greenwich and Paris Observatories—This measurement was rendered possible by the munificence of H.M. King George III, who inspected the work on 21 August 1784—The base was measured again in 1791 by Captain Mudge, as the commencement of the principal triangulation of GREAT BRITAIN.

LENGTH OF BASE reduced to M.S.L.

As measured by Roy	27404.01 feet
" " " Mudge	27404.24 "
As determined by Clarke in 1858 in terms of the Ordnance Survey Standard O ₁	27406.19 "

Col.-Commndt. E. M. Jack, Director-General of the Ordnance Survey, said : Before asking the Astronomer Royal to unveil this memorial I would like to explain briefly the circumstances which led to its erection. Rather more than a year ago, it was proposed to me that we should celebrate the 200th Anniversary of General Roy's birth by putting up a suitable memorial. I accepted the proposal with pleasure. Certain unavoidable delays occurred in putting the work in hand, with the result that instead of meeting in May 1926, as we had hoped, we are meeting to-day.

I would like to take this opportunity of acknowledging the permission given by the Trustees of the Hampton Parochial Charities for the enclosure of this terminal. They showed themselves sympathetic to the proposal, and met us as far as it was possible for them to do. I wish also to acknowledge very gratefully the help given by Mr. Mason, the present tenant of the site. He has helped us in every possible way, even to having ground cleared at his own expense. We are very grateful to him.

Sir Frank Dyson, Astronomer Royal, narrated briefly how Roy was led to take an interest in matters geodetic and cartographic, and described how in 1763 the Government considered making a general survey of the Island, and

Heath Base in that year was due to a suggestion by the third Cassini that the Observatories of Greenwich and Paris should be connected by a triangulation. His memorandum, though it produced such excellent results, was a tactless document. In it he roundly declares that there was an uncertainty in the longitude of Greenwich (with reference to Paris) of about 11 seconds, and in the latitude of about 15 seconds. What can have induced him to write such a remark about the latitude must remain a mystery. Maskelyne, the Astronomer Royal, was somewhat indignant, and wrote a rejoinder, in which he pointed out that the latitude of Greenwich was probably established without the error of a single second. However, the tactless wording of the suggestion was not allowed to interfere with the project of joining the two observatories.

Ten years earlier Roy and Maskelyne had been in correspondence about the Schiehallien experiments to determine the density of the Earth. Maskelyne was present at the re-measurement of the Hounslow Heath Base by Mudge in 1791. So far as I know, no Astronomer Royal has visited the base from that date until to-day.

In 1802 Mudge was at Greenwich testing Ramsden's new zenith sector, and in his report he acknowledges the value of the advice and instruction which he had received from Maskelyne in the matter.

We do not hear so much about John Pond, Maskelyne's successor, in connection with the Survey, but with the advent of Airy, in 1836, there is a change, and we find him and Colby in constant communication. Airy's Figure of the Earth was adopted by the Survey shortly after its publication in 1830. Airy also designed a new zenith sector for use in determining the latitudes of geodetic stations in the British Isles; this was in 1841. It was largely due to Airy, also, that Mean-Sea-Level was adopted as the datum for heights. Airy and Colby were very good friends, and after 1838, when Colby was living in London for a few years, Airy says that he "and his family had the gratification of receiving him very often at our Sunday dinner at Greenwich" (dinner was then at 3.30), and he goes on to pay a tribute to Colby's talents and unselfish public spirit.

I have said, perhaps, enough to show how closely in touch with Maskelyne and Airy were the founders of the Ordnance Survey, Roy, Mudge, and Colby, and how advantageous to the Survey this friendly alliance was. Sir Frank Dyson's presence here to-day is evidence that the tradition, now 170 years old, is still alive, and that the two national institutions, though less immediately in contact than they were in the past, are still aware of each other's existence. On behalf of all present I beg to thank Sir Frank Dyson for his friendly co-operation in doing honour to the memory of General Roy.

The following note is kindly sent by the Clerk to the County Council of Lanarkshire:

"William (General) Roy was the son of John Roy, gardener and Land Steward in the service of the Hamiltons of Hallcraig. His grandfather held the same post, and his uncle James Roy acted in a somewhat similar capacity under the Lockharts of Lee. General Roy and his brother James were educated at the school of their native parish (Carluke, Lanarkshire) under Mr. John Russell, and the former partly at the Grammar School of Lanark; it is uncertain whether General Roy had the benefit of any higher scholastic training. Old Ann Alexander, long a servant at Lee, used often to relate that General Roy, during her

service, came to 'The Lee' on three occasions: on the first occasion he dined in the servants' hall; next time he came he dined with the family; and at his third visit, which would be in 1764, when surveying the military works of the Romans in the neighbourhood, he sat at the right hand of the Laird."

REVIEWS

EUROPE

Wanderings in Roman Britain.— Arthur Weigall. London: Thornton Butterworth. 1926. $7\frac{1}{2} \times 5\frac{1}{2}$, pp. 342. *Sketch-map and Illustrations.* 6s. net.

MR. ARTHUR WEIGALL'S perambulation of Roman Britain, with the aim of satisfying the curiosity of the general public, was well worth while. Archæologists and historians are busy in various corners of their two fields, but few of them are able to appeal to a wide circle of readers. Mr. Weigall has just the right equipment for his task: he is both archæologist and historian, capable of taking a comprehensive view of the hundreds of sites he visited, and the wielder of a facile pen. His book, though by no means exhaustive, covers a great deal of ground, as may be seen from the index of Roman sites arranged under counties, and from the excellent art-paper map, generously supplied at both ends. The outstanding things are all here. A useful feature, and one that deserves expansion, is the setting forth of some of the chief objects shown in local museums. How these objects tend to be hidden, and how hard is it to know where to look for many unique specimens! Could not the Museums Association undertake the compilation of a Roman British list giving the *locale* of important specimens? Mr. Weigall properly lays stress on the "uncontrovertible but little-appreciated fact that the blood of the heterogeneous Romans still runs in our veins"; and he puts in a timely plea for the "endowment of scholarships and professorships for the training of field workers and students in practical archæology." Truly the harvest is plenteous, but the workers are parlous few and the funds ridiculously inadequate for the full development of this important side of our national life. S. E. W.

Suffolk Sea-Borders.— H. Alker Tripp. London: John Lane. 1926. $5\frac{1}{2} \times 7\frac{1}{2}$, pp. xii. + 254. *Eight Plates in Monochrome and 101 Text Figures.* 8s. 6d. net.

In any book ever published it is probable that some points offer themselves for criticism. The present volume does afford a few minor points of this sort, but it is not proposed to deal with them here. The book, from cover to cover, is most interesting and instructive. The writer really does make one feel the past greatness of the Suffolk shore. Every mud-flat, every beach he describes are real, and to one who knows and loves them they live again.

The theme of the book is an inconsequent yachting cruise along the Suffolk coast and its tortuous estuaries and Broads. It is very fully illustrated with some excellent pen-and-ink sketches and a few plates. Every lover of the Suffolk coast should read this book, no matter how well he knows the shore. Perhaps the highest praise we can give is to ask the writer to produce a similar work on the other—and not less interesting—parts of the East Anglian coast.

J. A. S.

Echoes in Cornwall.— C. C. Rogers. London: John Lane. 1926. $7\frac{1}{2} \times 5\frac{1}{2}$, pp. 272. 6s. net.

This book is scarcely one that lends itself to review in the pages of the *Journal*. For the most part it concerns itself with musings of a highly mystical kind suggested by the solitudes and silences of Cornish moors and tors, and to some extent also by the alleged aloofness of an old world "son or daughter of the soil." The chapter on "Punch Bowl Yarns" is full of excellent stories characteristic of Cornish humour at its best. The rest of the book, though cleverly written, is apt to grow somewhat wearisome from lack of variety and also a little depressing from its being generally pitched in a minor key. The "Glossary" of Cornish words at the end is somewhat misleading in that a large number of these are not at all specially characteristic of Cornwall, and are in familiar colloquial use in Derbyshire and other counties equally distant.

W. W.

Suomi: The Land of the Finns.— A. MacCallum Scott. London: Thornton Butterworth, Ltd. 1926. 9×6 , pp. 223. *Twelve Illustrations and Six Maps.* 7s. 6d. net.

Mr. MacCallum Scott's admiration for the progress of modern Finland is whole-hearted. He knows the Baltic countries well, and he loves the north. "The North!" he cries, "Fountain of youth and energy, Mother of truth and strength and valour, Nurse of freedom, Saviour of the world from the despotisms and slavery of the lotus lands of the South." He holds that Finland is the latest manifestation of this vital energy of the North, and the theme of his book is the extraordinary virtue of the Gothic or Scandinavian race, when blended with some other stock, in producing an outburst of energy, intellectual, artistic, and political.

In the historical section of this thoughtful and sympathetic book Mr. Scott shows that this vital energy is no modern characteristic of the Finns; it preserved their national individuality throughout the centuries, and when the time for the great national movement came, it was given expression by Ivar Arvidsson in the words: "We have ceased to be Swedes; we cannot become Russians; therefore we must be Finns"; while the modern Finn is the living exponent of the doctrine of the philosopher-statesman J. W. Snellman: "We Finns are few in numbers; we must make up for our numerical weakness by a widespread enlightenment."

Mr. Scott has much of interest to say on the subjects of Finnish literature and art; he shows how vehemently are the Finns concerned with their modern architecture, which in Helsingfors is a living art: there the architect works in an atmosphere of intense public interest, unfettered by the conventions of styles which have long since reached their limit of perfection.

The book is furnished with an adequate index, excellent illustrations, and some useful sketch-maps, and is a valuable addition to the growing literature on Finland.

O. R.

Franciscan Italy.— Harold Esdale Goad. London: Methuen & Co., Ltd. 1926. $9 \times 5\frac{1}{2}$, pp. xii. + 284. *Illustrations.* 15s. net.

The aim of this book is to treat of the history of St. Francis and his Order with special reference to the topography and the scenes in which it was unfolded. Franciscan Italy, therefore, centres mainly in Assisi and the neighbouring towns of the upper Tiber valley. The towns and buildings, so far as is possible, are described as they existed at the beginning of the thirteenth century, and as they exist to-day; but on the whole the biographical and historical elements

predominate. In these, the author is content to avoid controversial matter, employing the traditional sources to make plain once again the simple and attractive personality of the Saint.

Gallipoli To-day.— T. J. Pemberton. London: Ernest Benn, Ltd. 1926. 9 × 6, pp. 115. *Forty-seven Illustrations, including two Sketch-maps.* 10s. 6d. net.

It is an easier matter nowadays to visit the battlefields of France and Flanders than to gain access to the beaches of the Gallipoli Peninsula; but those who can manage the longer pilgrimage will carry away far more vivid impressions. The scarped cliffs of Helles and Anzac and the curving sandy beach of Suvla, backed by the rough tangle of scrub-clad spurs and ravines behind, combine to make an ineffaceable impress on the mind of the visitor, all the deeper and sadder for the visible monuments to our dead now erected on the sites of those epic struggles of 1915.

Mr. Pemberton's excellent little book is the best guide which has yet appeared for those intending to visit the Gallipoli monuments and cemeteries, which have now been completed. Though primarily written for New Zealanders, the book appeals universally to all relatives and friends of those who fell at the Dardanelles. As the author says, "Every cemetery on the Peninsula has a poignant interest for some thousands of relatives and friends of those who laid down their lives for their Empire." There are in all thirty-two of these cemeteries: six at Helles, four at Suvla, and twenty-two in the Anzac area. During five years of arduous work the Graves Registration Units at first, and then the Imperial War Graves Commission, carefully collected the scattered remains of the fallen and reburied them in these consecrated cemeteries, which have been solidly enclosed and beautified with trees, shrubs, and flowers. Finally, the great memorial pylons were erected under the supervision of the Imperial War Graves Commission. The difficulties of this task were enormous; the total number of our dead during the Dardanelles Campaign was between 30,000 and 40,000, but less than half that number of bodies could be identified. Mr. Pemberton tells us that "on marble panels round the balustrade of the great Helles memorial are the names of 19,000 British soldiers and sailors, and of 200 Australian soldiers, who died and have no known graves."

The author describes in accurate detail each of the cemeteries, and illustrates his descriptions with excellent photographs; but he does more than this, for he gives us a true and pleasing picture of the surroundings, of the landscape of the Peninsula, and of the birds and flowers which inhabit it. For of human inhabitants the Peninsula contains comparatively few, and it is this solitude which is perhaps its chief charm.

The book is marred by very few errors. The "Division" of British troops which occupied the Kelia flat in 1922-23 was really only a Brigade (pp. 38, 39). The wording below Plate 14, which shows the walls of Troy, is somewhat misleading; the Roman wall is the one in the centre of the photograph, while the Mycenaean masonry appears in the foreground to right and left. A few misprints have also crept in; for instance, "Lulu Baba" for "Lala Baba" on p. 16 and Plate 36, "Mukda" for "mukhtar" on p. 51, "cesmi" for "sesame" on p. 56, and "Chunuk" for "Chanak" on p. 98. These, however, do not detract from the usefulness of the book as a guide to the monuments and cemeteries of Gallipoli, or as a memento for those who have no opportunity for a personal visit. The author has succeeded admirably in presenting a faithful and sympathetic picture of the Gallipoli graves and their surroundings.

J. H. M. C.

ASIA

Passenger to Teheran.— V. Sackville-West [The Hon. Mrs. Harold Nicolson]. London: The Hogarth Press. 1926. 9 × 6, pp. 182. *Illustrations*. 12s. 6d. *net*.

This account of a journey to Iraq, Tehran, and Isfahan is of greater interest than its title would lead one to suppose, as the author possesses remarkable gifts of observation and description. Her first impression runs: "Persia has been left as it was before man's advent. Here and there he had scraped a bit of the surface, and scattered a little grain; here and there, in an oasis of poplars and fruit trees outlining a stream, he had raised a village, and his black lambs skipped under the peach-blossom; but for miles there was no sign of him, nothing but the brown plains and the blue or white mountains, and the sense of space."

At Tehran, with characteristic insight, an hour was spent at one of the city gates and revealed its life "streaming disconnectedly in and out," with strings of camels, droves of donkeys, and veiled women, while carriages, a motor or two, and bicyclists lent a modern note.

The author was present at the coronation of Shah Riza Pahlavi, and gives an admirable account of it. She was by no means favourably impressed by the mullas—"dirty, bearded old men in long robes and huge turbans, like a baleful chorus in a Greek play," and it is interesting to note that the new Shah has, to a great extent, deprived them of their power for evil. But she is at her best at Isfahan, a real Persian city, hardly affected by European influence, and her account of the crowds in the bazaar and of the old-world atmosphere, makes delightful reading. The illustrations are good, but it is a pity that there is no map. P. M. S.

Records of the Survey of India.— Volume 19. The Magnetic Survey of India, 1901-20. Prepared by Lieut.-Col. R. H. Thomas, D.S.O., R.E. and E. C. J. Bond, V.D. Dehra Dun. 1925. 13½ × 8½, pp. xii. + 121. *Maps and Plates*. 4 Rupees or 6s. 9d.

The first general magnetic survey of India was proposed in 1896 by Sir John Eliot and General Strahan, supported in this country by Sir William Christie (then Astronomer Royal), Sir Norman Lockyer, and the Observatories Committee of the Royal Society. The Government of India approved the project and entrusted its execution to the Survey of India. The publication of volume 19 of the Records of the Survey, in which the results of the work are set forth, marks the completion of this great undertaking.

The magnetic survey was planned on sound practical lines by Captain H. A. D. Fraser, after consultation with Sir Arthur Rücker, who with Sir Edward Thorpe had made two magnetic surveys of this country. Captain Fraser also designed a serviceable magnetometer for the field observations. The latter were begun in 1901 and practically completed by 1913; complete observations of the declination and dip of the compass needle, and of the intensity of the horizontal magnetic force, were made at 1401 stations, including forty-one in Ceylon and four in the Andaman Islands. The stations were on the average 30 to 40 miles apart. While small countries like the United Kingdom or Holland have recently been surveyed in much greater detail, the Indian network of stations is fairly close for a region so great, and incomparably surpasses the only previous attempt at a magnetic survey of India, made by Von Schlagintweit more than half a century before.

The field observations have to be corrected to give the corresponding

annual mean values in their localities, by allowing for the daily magnetic variation (depending on the local time of the observation), for any accidental magnetic disturbance which may have existed at the time, and for any annual and secular change in the magnetic force. The first two corrections can be ascertained only from continuous records of the magnetic changes; for this purpose four magnetic observatories (in addition to the long-established one at Bombay or Alibag) were instituted, at Dehra Dun, Kodaikanal, Toungoo, and Barrackpore; the first three lie nearly at the extremes of India in the south, north, and east directions. Besides fulfilling an indispensable function in relation to the survey, these observatories have collected data of great value for the investigation of other aspects of terrestrial magnetism, supplementing the material from Bombay which has proved so fruitful in the hands of Dr. N. A. F. Moos, formerly superintendent.

These observatories also determine the secular magnetic change in their respective localities, but this secular change is so large and so irregular in its distribution that intermediate determinations of it are necessary. Hence eighty of the stations were permanently marked in order that observations might be repeated in precisely the same spots from time to time, so giving the secular change in each locality. Observations made at these stations in 1914-5 were repeated in 1919-20.

Just before the war a committee of three, presided over by Sir Gilbert Walker, was appointed to advise on the reduction of the observations, and they presented a short and admirable report (included in the volume under review) giving a simple and convenient method, which in the main was subsequently adopted. But the execution of the work was delayed by the war, and when work was resumed it seemed desirable not only to reduce the data to their mean epoch, 1909, but also to bring it more nearly up to the date of publication by allowing for the subsequent secular changes. Hence the repeat stations were reoccupied, as stated, and the original data corrected to 1920 as well as to 1909. Tables and maps showing the data corrected to each of these epochs are contained in the volume; also the annual magnetic changes in the three elements of magnetic force are given for the periods 1902-9, 1909-15, 1915-20. The changes undergone since then are unknown, and already the need arises for further repeat observations to bring the results of this volume up to the present date; without this it will not be possible to give accurate values of the magnetic declination on the local maps issued by the Survey. Unfortunately, since 1923 only one of the new observatories instituted for the purpose of the Survey has been maintained, so that unless, as is to be hoped, the interruption of their activity is only temporary, the continued correction and later repetition of the survey cannot be effected with the same standard of accuracy observed in the present survey.

The report gives full details of the instruments and methods of observation and reduction, and the work appears to have been done in a careful and satisfactory manner. The maps show that India has many localities with marked and in some cases unusually great magnetic irregularities. The results should be useful for many local purposes, such as mine surveying, in India, and in addition they have a wider scientific value as a substantial contribution to our knowledge of the magnetic properties of the globe.

The Survey of India has great responsibilities to science in respect of the wide area over which it operates; this welcome volume is further evidence of the worthiness of its trusteeship.

S. C.

Seaports of the Far East.— Compiled and edited by Allister Macmillan. Third edition. London: W. H. & L. Collingridge. 1926. $11\frac{1}{2} \times 8\frac{1}{2}$, pp. 608. *Map and Illustrations. Four Guineas net.*

The first edition of this comprehensive guide to the commercial activities of the Far East appeared in 1923. Though largely increased in size, this edition is produced on the same lines, including historical and descriptive surveys, and with profuse illustrations. To some extent the volumes are complementary, for in this edition the Japanese Empire and the Philippine Islands have been brought within its range, and the section on Siam and Bangkok omitted. The Japanese section is especially full, and deals with the seaports of Kobe, Osaka, Tokyo, Yokohama, and Manchuria and Dairen. With a certain amount of compression Mr. Macmillan should be able finally to produce a definitive volume, comprising all the ports dealt with in the various editions—a volume which would be of great value as a reference work for the Far East.

On the Trail of Ancient Man.— Roy Chapman Andrews, Sc.D., with an Introduction and a Memoir by Henry Fairfield Osborn. New York and London: G. P. Putnam's Sons, The Knickerbocker Press. 1926. $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xxiv. + 375. *With Fifty-eight Photographs by J. B. Shackelford. 25s. net.*

In November last the distinguished leader of the American Central Asiatic Expeditions delivered the Second Asia lecture before the Royal Geographical Society. His lecture was a brief survey of the plan of exploration together with an account of the more interesting discoveries. In this volume he elaborates his subject. He gives us a popular and detailed narrative of the work and discoveries of all the expeditions. To Dr. Roy Chapman Andrews is due the conception of this elaborate enterprise which consisted in a succession of expeditions to Mongolia, commencing in the year 1916 and lasting over a period of ten years. And to him is due their successful accomplishment. But in addition we feel the influence of Professor Fairfield Osborn pervading and supporting the ambitious scheme. He associates himself with this preliminary narrative by supplying a foreword to the volume and including in it a popular chapter on Palaeontology.

Dr. Andrews is guided by two main principles. The first is cooperation, the bringing together of men trained in different sciences and concentrating their varied activities on one broad scientific problem. The other is efficiency, the evolution of some means of rapid transportation which will enable the maximum of scientific work to be done in the minimum of time. The elaboration of this second principle opens up new methods of geographical exploration. It consisted in the employment of a fleet of motor cars, divisible into three separate units, and supported by a caravan of camels. Each unit was self-contained and could maintain itself independently in the field. The method certainly fulfilled its purpose. The volume gives an impression of American hustle backwards and forwards through the Mongolian desert. This mode of exploration is at least novel. The book tells us something of the difficulties involved in it. We have motors bogged in quicksands, motors falling down ravines, motors obstructed by snow, by rivers, by ditches, by rocks. But the difficulties in organization must have been far greater. We are left to imagine the arrangements with preliminary objectors, the hours of careful forethought, the planning and replanning, the problems of petrol supply, the cooperation with the caravan. All these, and many other administrative problems, must have been a source of constant anxiety to the leader. Nevertheless, his faith in the cars remains unshaken. He will use them to ascend Mount Everest.

The author makes no claim for adventure in his enterprise. He rather lains adventure. To him adventure means faulty administration. His iness as a leader is to eliminate adventure and to counteract every difficulty distraction that might hinder solid scientific work.

The main discoveries relate to palæontology. Fossil profusion pervades the sk. In one place they collected seventy-five skulls within an area of 3 miles. e skull of *Baluchitherium*, the largest of land mammals, was perhaps ir most spectacular find. That of *Protoceratops*, a diminutive reptile, was most brilliant from a scientific standpoint. All extremes in size are represented. In one place it is the uprooting of *Baluchitherium*, in another the osure of a fossil mosquito. The discovery which has received most popular ention is that of the famous dinosaur eggs. These egg-shells seemed as ndant as the fossils. At one spot 750 pieces of shell were collected in an ernoon. The place must have been an incubator for dinosaurs.

The volume teems with points of interest to the Naturalist. Who would ect to find a woodcock in the Gobi! Who would believe that a vulture in rty minutes could devour half an antelope which weighed 60 lbs.! Motor ases in the desert bring out interesting facts. We learn that the pace of the ld ass is 40 miles an hour, that a gazelle can reach 41 miles an hour and atinue for a distance of 10 miles. The reviewer can confirm this amazing eed. He chased Arabian gazelle round Ur of the Chaldees, driving them a rate of 40 miles an hour for a distance of 6 miles.

Were space available we would write more of this excellent book. It is a lendid record, beautifully illustrated, admirably told; and we particularly mmend the lucid exposition of the varied assemblage of scientific facts.

R. W. G. H.

FRICA

ie Geography and Geology of the District between Gebel 'Atâqa and El Galâla El Bahariya (Gulf of Suez).— H. Sadek, Ph.D. (Survey of Egypt : Geological Survey. Survey of Egypt Paper No. 40.) Cairo : Government Press. 1926. 11 × 7½, pp. viii. + 120. *Diagrams and Geological Map on Scale 1/100,000. P.T.10.*

Since Schweinfurth's two visits, made between forty and fifty years ago, e portion of the Red Sea littoral described in this report, although close to ez and easily accessible from Cairo, had received little attention. In the esent memoir Dr. Sadek and his colleague, Mr. P. A. Clayton, of the Desert rveys, bring our knowledge of the district into line with that of the many her desert areas which, thanks to the petroleum stimulus, have been surveyed very considerable detail during the last few years. The district embraces a area of 1500 square kilometres, and lies between the north Galala massif n the north side of Wadi Araba) and Gebel 'Atâqa, the familiar flat-topped ill-mass immediately to the south-west of Suez. The high physical relief f this interesting tract is rather suppressed in the geological map accompanying e report, but doubtless Mr. Clayton's survey is available as a purely topo- raphical sheet issued by the Desert Surveys Department. As a whole the rea is a wide depression flanking the Gulf of Suez, comprising the basins of e wadis Hagul and Bada on the north and that of Ghweibba on the south, e two first-mentioned being separated from the last by Gebel el Akheider, a old forked promontory of the inland Eocene plateau. In its western extension e northern portion of the depression is divided by a second headland, Gebel m Zeita. Dr. Sadek states that north and south of Wadi el Bada the country ; inhabited by the Houetat Arabs and the 'Amarin section of the Ma'azza

spectively. As compared with the greater part of the Eastern Desert it appears that grazing is above the average; and except after long drought the supplies yielded by the permanent wells are supplemented, with more than usual frequency, by water available in pot-holes and "galut" (natural rock-sterms), and by the ground-water of "themail."

Dr. Sadek's excellent geological map and lucid description of this highly-ulted district will be welcomed by all interested in Egyptian geology, more pecially as his work throws light on several knotty problems. The author to be congratulated on locating an exposure of Jurassic rocks at the base of e north-east extremity of the Galala—the first time the existence of strata that age has been recorded definitely in Egypt proper. The difference own by Dr. Sadek to exist between the Cretaceous-Eocene stratigraphical quences in the north and in the south of the area is of considerable importance. . the Galala hills on the south the complete and conformable succession of etaceous, Lower Eocene, and Middle Eocene indicates that there, as in nai and throughout the greater part of Egypt, there was continuous marine bmergence; whereas in the north (Gebel Ataqa) the shallow-water nature the higher Cretaceous beds and the complete absence of the Lower Eocene, int to emergence of the sea-bed during a prolonged period, with a resulting arked unconformity between the two formations—conditions analogous to ose which obtained in the Abu Roash area near the Great Pyramids.

Dr. Sadek's work shows that the plateau-blocks are everywhere bounded . lines of fault. Two main fracture-systems are recognized, running ectively north-west by south-east (varying to north-north-west by south-uth-east) and east and west. The former are apparently of late Eocene / Miocene age and do not affect the Miocene strata which occupy the low ound of the depression. The author's careful study of the dislocations ids to confirm the now widely held view that the region occupied by the odern Gulf of Suez and its bordering maritime plains is a tectonic depression ich was invaded by the Mediterranean Sea in Miocene times. The Miocene posits of the area, which are described in detail, show interesting differences m those known in other districts of the Gulf of Suez and Red Sea, notably e absence of the usual masses of intercalated gypsum. A statement of r. Sadek's conclusions regarding the levels attained by the Miocene sea in s district would have been welcome could it have been added to the mass ew information contained in this valuable contribution to the geology of e Near East.

H. J. L. B.

istoria de Arzila durante o dominio portuguez (1471-1550 e 1577-1589).—

David Lopes. Coimbra: 1925. 9 × 6, pp. xl. + 492.

This work is founded on the 'Anais de Arzila' of Bernardo Rodrigues, ich Senhor David Lopes edited some years ago; and by way of introduction e author, in his preface, puts and seeks to answer the interesting question : hy did the Portuguese go to Morocco? This leads him to examine the causes the expedition to Ceuta in 1415, the first of their overseas conquests. Two ent writers have contended that King John I. chose the city for attack ause it was the chief trading centre of Morocco, an emporium of Eastern oducts, and because its possession would enable the Portuguese to obtain e corn grown in the adjacent country and thereby make up for the chronic icit in this article at home. With his knowledge, practical and historical, North-West Africa, Senhor Lopes shows that the facts do not justify this othesis, and in his view the aims were different. Ceuta had always been e of the bridgeheads for incursions into the Peninsula from the south, and

if it were held by Christians a new invasion would be rendered more difficult. Moreover, the city was a first-rate naval base; it would, and did afterwards, serve to check Moorish piracy on the coast of the Algarve; it would also enable protection to be afforded to the seaborne trade from Italy to Portugal passing through the Straits, which was very valuable before Vasco da Gama opened the route round the Cape. Crusading zeal was another, if not the principal, motive of an enterprise directed against the secular foe. The Portuguese had driven the Infidel from their own country; they now had strength enough to follow him into his. It was a meritorious work for which the Church granted Indulgences, and the like zeal led King Alfonso V. and King Manuel I. to seize other places and to extend their dominion to the extreme south-west of Morocco. The conquests of the last monarch were even commercially profitable, but not for long. A Mohammedan reaction set in, and, finding that the fortresses cost much in blood and money to maintain, John III. abandoned some of them. For the same reason England retired from Tangier, which had been ceded to her as part of the dowry of Queen Catherine of Braganza. The rule of the Portuguese in Arzila, though it lasted a century, was, like that in the other fortresses, only an episode in Moroccan history; though marked by constant fighting, much suffering, and many brilliant deeds of arms, it did not prove to be what we should now call a good investment. If however we are to appraise it rightly, we must consider it as part of the movement of national and religious expansion which carried the banner of the *Quinas* and that of the Cross over a great part of the world.

E. P.

Vom Wirtschaftsgeist im Orient.— Alfred Rühl. Leipzig: Quelle und Meyer. 1925. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 92. *Rm.* 3.60.

The title of this interesting little essay is not only somewhat obscure at first sight, but is also not easy to translate into English. It may be given as 'The Oriental Outlook on Economic Problems,' but even so requires further elaboration. Professor Rühl defines (after Junge) the Orient of his title as implying the simultaneous presence of some at least of the following four factors: a dry climate, Islam, the irruption of Turkish, Arabic, or Persian racial stocks, and an antecedent extension of the Hellenistic zone of culture. The term is thus used in a wider sense than our "Near East." Again, the author considers that there has been a tendency in the economic sciences to neglect the actual human being, adapted to a specific social and physical environment, in favour of the abstract *homo æconomicus*. Having studied the economic psychology of the Spaniard, he proceeded to an investigation of oriental economy. The whole Orient could obviously not be treated in a short essay, and in order to obtain a compact area, already fully investigated from various standpoints, he was led to choose Algeria. His booklet is therefore a study of the economic outlook of the natives of Algeria, and of the factors which have gone to the shaping of that outlook.

The great bulk of the native population he regards as forming a unit, though it is pointed out that where the Berber folk, as in the Aures Mountains and in Jurjura, are more or less definitely isolated, they present marked differences from the Arabs or peoples of mixed Arab and Berber blood. As contrasted with the Algerians proper, the Jews and the M'zabites or Mozabites are regarded as sufficiently distinct to merit separate treatment.

The general conclusion is that the Algerians show on the one hand certain primitive traits, while on the other their economic life recalls that characteristic of mediæval Europe, which persisted to a large extent till the beginning of the industrial period. Within the Algerian community religion is the dominating

factor, but Professor Rühl holds that the significance of Islam in the production of the cultural characteristics can easily be overrated: emphasis upon one particular form of religious belief tends to obscure rather than to elucidate the facts. Some of the supposed influences of Islam he assigns indeed to historical and geographical causes rather than to the nature of its basal postulates.

If the section on the Jews adds comparatively little to what is generally known as to the part played by this people in a community where they are the chief holders of liquid capital, that on the Mozabites deals with facts which are much less familiar. The latter, largely because of the nature of their original habitat in a group of desert oases, have taken a long step in the direction of capitalistic economy. They have been called the Puritans or Calvinists of Islam, and are said to show not a few analogies to the Puritan stocks of Europe in the way in which they have grasped economic power to an extent out of all proportion to their actual numbers.

The book forms a valuable contribution to our knowledge of the Atlas Lands.

M. I. N.

South Africa from Within.— Manfred Nathan, K.C. London: John Murray. 1926. 9 × 6, pp. 324. *Map.* 12s. *net.*

Mr. Nathan is favourably known as the author of a book dealing lucidly with the constitution of the Union of South Africa. In the first part of his new work he gives a summary of the history of South Africa from the discovery of the Cape of Good Hope to 1925. As he suggests, this summary is chiefly valuable for events since the establishment of the Union in 1910 which (except in the New Volumes of the *Ency. Brit.*) have hitherto gone unrecorded in book form. The impression left is that the author's sympathies are "Nationalistic." The frigidity of his references to Lord Milner will not escape notice, nor the warmth of his regard for Lord Selborne.

In the second part of the book we are given sketches of South Africa as it is—the country, the people, industries, commerce, political parties and problems. Here Mr. Nathan's intimate acquaintance with the country is manifest; the only difficulty being that in parts there is too much condensation, due doubtless to the desire to pack as much information as possible into a short compass.

There are a few doubtful or erroneous statements. On p. 112 we read that one of the first acts of the Campbell-Bannerman Administration "was to cancel the importation of Chinese labourers into South Africa"; on p. 117 we are told that it was the Botha Government in the Transvaal which decided that the Labour Ordinance relating to the Chinese would not be renewed. The second statement is correct. Mr. Nathan is misleading when he says (p. 239) that the Colonial Office has "become the office of the Secretary of State for the Dominions with two departments, one for the Dominions and the other for Crown Colonies and Dependencies"; the two offices being in fact independent, though Mr. Amery is at the head of both. F. R. C.

The Making of Rhodesia.— Hugh Marshall Hole, C.M.G. London: Macmillan & Co. 1926. 9 × 6, pp. xi. + 415. *Maps and Illustrations.* 18s. *net.*

An authoritative account of the making of Rhodesia has long been needed. In this book Mr. Hole gives us, clearly, adequately, and in the moderate compass of some 400 pages, what was wanted. The author has spent twenty-three years in Rhodesia, was acquainted with all the chief actors in the early days, and had some share in shaping the events he describes. An official of the Chartered Company from its inception, he has nevertheless, he tells us, not tried to glose over any shortcomings. His book shows that he has suc-

ceeded in preserving a judicial mind, as far as that is possible to a man who was a whole-hearted supporter of Rhodes's policy. Consequently he regards Mackenzie (who sought expansion northward under direct Imperial control) as a "fanatic"—sincere and single-minded, but still a "fanatic." This bias, noticeable too in some of the references to the action of the Imperial Government, does not prevent occasional criticism both of the Chartered Company and of the settlers, nor interfere with the author's presentation of facts.

To any one who, like the present reviewer, has followed South African affairs from a period ante-dating Majuba, this book is full of fascination. The old stirring days are lived over again, and blanks in our knowledge are filled. To a younger generation the interest should be as keen; to the student the volume will be indispensable. The main narrative covers the period from about 1870—the days of the first concession hunters, Sir John Swinburne and Thomas Baines—to the close of the rebellion in Mashonaland in 1897. For Northern Rhodesia, where events moved more slowly, the story is continued to 1906. By that time the pioneering days had ended, and many of the chief actors had passed from the scene of triumph and defeat—notably Lo Bengula and Cecil Rhodes, the two most striking figures in Mr. Hole's book.

There are some acid references to the Aborigines' Protection Society ("that well-meaning but injudicious body"), and "the march of civilization" evidently, with Mr. Hole, is typified in the progress of white settlement. Yet he has an obvious understanding of and considerable sympathy with the African, and he gives valuable information concerning the history and social development of the Matabele, the Barotse, and other tribes.

A commendable feature of the book is the full citation of authorities. The index, too, is much better than, from bitter experience, we expected to find it. There are four sketch-maps and a fuller map of Rhodesia, which however lacks any indication of the hills or contour of the land. There are also a number of photographs, one showing Sir Sidney Shippard at Bulawayo in 1888 wearing a frock-coat.

F. R. C.

AMERICA

Down the Santa Fé Trail and into Mexico, 1846-1847.—The diary of Susan Shelby Magoffin. New Haven: Yale University Press; London: H. Milford. 1926. 9½ × 6½, pp. xxv. + 294. *Illustrations.* 20s. *net.*

Memories of the Old Emigrant Days in Kansas, 1862-1865.—Mrs. Orpen. Edinburgh: Wm. Blackwood & Sons, Ltd. 1926. 9 × 5½, pp. ix. + 324. 15s. *net.*

The diary of Mrs. Susan Magoffin gives an interesting picture of the early days of the expansion of the United States in the south-west, and of the pioneers, men and women, who made it possible. The writer was a young bride, scarcely eighteen years of age, who in 1846 accompanied her husband, Samuel Magoffin, a native of Kentucky of Ulster descent, on a trading journey from Independence to Santa Fé, El Paso, and Monterey. To the ordinary risks of such a journey—though from this account they were scarcely as hazardous as they have sometimes been painted—were added those arising from the war between the States and Mexico. In this war, which almost without bloodshed added New Mexico to the Union, her brother-in-law, James Magoffin, played an important part, for it was largely as a result of his mission to Santa Fé, referred to briefly in this diary, that the Mexican opposition fizzled out. James was afterwards captured and imprisoned at Chihuahua, where, however, he is said to have saved his skin at the expense of "three thousand three hundred and ninety-two bottles of Champagne wine." The diary is very circumstantial

and punctuated with somewhat tedious moralizing; but it is not without its humour, and is interesting as a contemporary record of an important incident in American history.

The next stage in the westward expansion is dealt with in Mrs. Orpen's book. Her father, an engineer, anticipated the building of the Santa Fé railroad, and settled in Kansas to be on the spot. His daughter joined him at the age of eight in 1862, and for some years shared the strenuous life of a settlement on the edge of civilization with nothing between it and the Rockies. Her story is, of course, concerned with the details and incidents of everyday life, but it had its moments of danger—she lived within the sphere of Confederate raids—and the picture is vividly drawn.

The South American Handbook, 1927.— Edited by J. A. Hunter. London: South American Publications, Ltd. 1926. 7 × 4½, pp. lxxviii. + 706. *Map and Diagrams.* 2s. 6d. net.

The issue for 1927 of this Handbook, founded upon Koebel's 'Anglo-South American Handbook,' has been enlarged and at the same time considerably reduced in price. It is designed to meet the needs of tourist, sportsman, and business man, and it is arranged in a form which makes it easily consultable. Besides the general chapters each state is dealt with separately, a method which does not avoid repetition. Though much of the information can of course be approximate and generalized only, there is considerable detail in some cases, as, for example, the railway communications, and tourists' itineraries. More room than is usual in works of this kind is also devoted to the geographical outlines. Altogether it would be difficult to obtain elsewhere so much information on South America in so handy a form, and the annotated list of books indicates further sources of information. It may be noted that emigration of British to the continent generally, without definite prospects, is strongly discountenanced.

The Lonely Island.— Rose Anne Rogers. London: G. Allen & Unwin, Ltd. 1926. 8 × 5½, pp. 233. *Illustrations and a Map.* 7s. 6d. net.

Tristan da Cunha merits the name of the lonely island, for no inhabited part of the British Empire is less accessible. It is the only colony with no governor, no laws, no taxes, and no mail service. In the days of sailing ships it was in frequent touch with the outer world, but steamers seldom go near it. Yet it has a civilized and enterprising population of about 140 people, most of whom are so devoted to their island home, in spite of its drawbacks and hardships, that they have no desire to leave it. Since its first settlement, about a century ago, three clergymen at different times have spent a few years on this little wind-swept island of 4 square miles. To them the islanders owe all the education that most of them have had. The last was Rev. H. M. Rogers, who with his wife lived there from 1922 to 1925. During that time, besides the ships that gave him passage and a few South Georgian whalers, only two vessels called at the island—H.M.S. *Dublin* on a special mission with stores, and the *Quest*, on her return from the Weddell Sea. The islanders live on fish, mutton, potatoes, and apples. They have a few cattle. Grain and other requisites are obtained from passing vessels, and in consequence periods of want are frequent. But they are a happy and healthy community, remarkable both for their good teeth and their longevity, probably the outcome of their diet and simple life. Clearly there is no truth in the stories of the degeneracy due to inbreeding. Beyond a few blue books, there was previously only one volume devoted exclusively to Tristan da Cunha. Mr. Rogers died on his

rn to England, but fortunately Mrs. Rogers has written an account of their on the island. With its vivid descriptions of the incidents of uneventful s, and its account of island customs, it is an entertaining volume, and there eographical value in Mr. Rogers' account of his visits to the little-known ccessible and Nightingale islands. A useful addition would have been a eorological record, if such was kept, and especially records of sunshine in tion to health. There are a few good illustrations. An appendix gives itition sent by the islanders to the Colonial Office in favour of an annual l by arrangement with some steamship company or by a warship from the e Station. It is difficult to understand why this modest request was refused, hat it is impossible to overcome the difficulties. This outpost of Empire ly merits some little attention

R. N. R. B.

THEMATICAL AND PHYSICAL GEOGRAPHY

est, Steppe, and Tundra.— Studies in Animal Environment. Maud D. Haviland (Mrs. H. H. Brindley). Cambridge: University Press. 1926. 9 × 6, pp. 218. *Illustrations and Map.* 12s. 6d. *net.*

We are told in the Preface that this book is based on a course of lectures vered at Cambridge during 1924. The nature of the audience is not cated, but we gather from internal evidence either that it was one of students oology, or at least that this element was well represented. In the Intro- tion, on the other hand, it is stated that the inspiration came from a series ersonal visits to certain of the great natural regions of the world, beginning .914 with a visit to the tundras of Siberia in company with the late Miss plicka, and culminating in one to the tropical jungle of British Guiana in 2, the Russian steppe having been visited in the interval. These expeditions used in the author an intense interest in animal ecology, and in the ways hich, alike in structure and in behaviour, animals are adapted—or strive dapt themselves—to the physical conditions. In the book these two separate nes, the personal observations of an enthusiastic naturalist and collector, the study of animal ecology as it appeals to those assumed to have already onsiderable knowledge of zoology, are blended. Now no geographer, vever limited his knowledge of animal biology, can afford to neglect the ervations of one at once privileged to visit parts of the world where the natural a and fauna persist almost unaltered, and fully competent to profit by the ortunity. On the other hand, the geographer's direct interest in *e.g.* such stions as the validity of the theories of protective and warning coloration, nicry, and so forth, is at best small. We emphasize these points because eographer, picking up the book at random and glancing at some of the plates at certain sections of the text, may decide hastily that despite its, to him, ractive title, the book is of no great interest, and would lose much in conse- ence. Its value seems to us to lie less in the general descriptions of rain- est, steppe, tundra, and taiga, which follow more or less familiar lines and ot strong on the purely geographical side, than in the incidental details ich often illuminate in vivid fashion the influence of the physical conditions life. As examples we note the statement as to the effects of shafts of sun- ht penetrating through the dense canopy of the equatorial forest and reaching : surface of the ground. Such a shaft was once observed reaching a party ants devouring the body of a caterpillar. As the direct ray approached the ts they fled to shelter, and the remains of their meal shrivelled up as if before urnace. The deduction is that most of the animals of the forest are exceed- ly intolerant of the equatorial sun, and exist there because the dense vegeta-

ion gives so many opportunities for shelter. Almost as striking are the observations on which depend the assertion that, despite the heavy rainfall, the occupied parts of the rain-forest are deficient in accessible water; for it is the upper tiers rather than the ground-level which are really rich in animals. Emphasis is laid on the part played by the reservoirs formed by the leaves of many epiphytes, which enclose little bodies of water, and by the innumerable sap-sucking insects, such as leaf-hoppers and frog-hoppers, which discharge the surplus absorbed as a sweet fluid, which again forms the main water supply for many other kinds of insects, incapable of obtaining cell-sap directly.

Many similar points might be mentioned. It is perhaps sufficient to say that if the main appeal is to zoologist and naturalist, in detail the geographer will find much of value to him in the book.

M. I. N.

HUMAN AND HISTORICAL GEOGRAPHY

The Primitive Races of Mankind: a Study in Ethnology.— Max Schmidt.

Translated by A. K. Dallas. London: Harrap & Co. 1926. 9 × 6, pp. 360. 6 Maps, 80 Plates, 11 Illustrations in the Text. 21s. net.

Prof. Schmidt has set himself the task of writing the first really systematic text-book of ethnology, a term which he uses for the science of the races of mankind, reserving "ethnography" for a description of individual peoples, which is also the English practice; but he follows certain other Germans in restricting ethnology to the study of mankind outside the circle of Asiatic and European civilization, though he agrees that it is legitimate to include in ethnology all that lies outside these civilizations which has not yet been worked, at least in a systematic way, by the archæologist. Therefore the book deals almost solely with the Americas, Africa, and Oceania. The book is evidently written mainly for Germans, and hence, with the exception of two references to Frazer and two or three to Tylor, no English author or field worker is referred to. The contributions of Rivers to the methodology of ethnology are ignored, as are the theories associated with the names of Elliot Smith and Perry; American ethnologists receive slightly better treatment. The first part of the book consists of sections on Voluntary human activities as related to (1) the human individual, (2) surrounding nature, (3) surrounding humanity, (4) the intellectual side of human nature. The first includes: all actions which are directly connected with the taking of food, treatment of the body, sexual satisfaction, amusement and worship; in other words, pleasurable activities. The second deals with man's relation to nature, and material economy, *i.e.* primitive production, transformation of materials, transport of commodities, preservation of commodities. The third treats of the social limitations of the satisfaction of human wants, that is, the social side of human life. The fourth is also termed the limitations of voluntary activities by the intellectual environment; this includes a supplementing of a man's own experience from the ideas of his fellow-men. By the intellectual civilization of mankind is meant the sum-total of all psychical experiences of mankind at a given time. In other words, this subdivision comprises all that is connected with the mental or intellectual aspect of human activity; the chief phenomena here are manners and customs, art, and religion. This last section is treated very briefly, and is by no means satisfactory.

The various minor sections of the book are further analyzed in a manner that makes for precision, though those who have special knowledge will be inclined to disagree with the author in many places—for instance, in the treatment of skin deformation (p. 69), of which there are more than two types.

(moko, and a thread drawn through the skin, etc.). "Scar-tattooing" (pl. 69) is a contradiction in terms, and the classification of boats (p. 141) is open to criticism; it is unnecessary to give further examples. Carelessness is shown in attributing betel-chewing to the Polynesians (pp. 62, 66). Attention might have been drawn to the orientation of the dead in burial, as this is often very significant, but perhaps the limitations of space may account for much that is treated too succinctly or omitted altogether.

The second part of the book is ethnographical. Here the accounts of the physical anthropology of the various peoples are not of much value to students who are interested in the discrimination and grouping of the various human stocks. On the whole a satisfactory account is given of the mode of life implements, social organization, and other features of most of the groups in the areas dealt with. Statements are sometimes made of the occurrence of some object in a country, when as a matter of fact it has but a very limited range; a qualifying clause would remedy this. On p. 268 we read, "Bows and arrows are used only in the extreme north-east" of Australia; it would be interesting to know if there is any record of any one having ever seen an Australian using a bow; of course it is well known that the bow-using Torres Straits Islanders occasionally visited the Cape York region, and thus a voyager may have seen bows and arrows there. In the account of Bantu prefixes (p. 296) an unfortunate example is given: the Buganda do not call themselves Waganda, and their language is luganda, not kiganda—the "Wa" and "Ki" are Kiswahili terms. Notwithstanding those matters which are open to criticism, Prof. Schmidt has written a useful book. Many details are from his own observation in South America, and there is much that will be new to the ordinary reader. The illustrations are particularly good and add greatly to the value of the book. The translation appears to be well done.

A. C. H

Cotton-Growing Countries, Present and Potential.— International Institute of Agriculture, Rome. London: P. S. King & Co. 1926. 9½ × 6½, pp. xxxvi. + 317. 12s. 6d.

The work of the Institute is so well known that it is scarcely necessary to expatiate on the character of this volume. It is practically a sequel to the monograph on 'The Cotton-Growing Countries' published in 1922, and it brings things so much up to date that some important particulars are included even for the year of issue (1926). The statistical tables of production, consumption, trade, etc., are invaluable. The method of collecting them, of course, allows some national optimism to emerge; but each contributor writes under a full sense of official responsibility. The one unsatisfactory feature is a curious absence of geographical instinct in the editing; it comes out also in the general text, but is most disturbing in the Summary and General Notes. For instance, on p. xiv. the editor states that the world's cotton, with few exceptions, is grown between 40° N. and 30° S.; and he then goes on to say that the chief exceptions "are in North China, Turkestan and Korea, South Africa, and Argentina." This might suggest some haziness on his part as to the approximate latitudes of Peking, Durban, or Rio de Janeiro, and is really a most misleading statement. With regard to China and Korea very careful investigation may perhaps justify the assertion that the merest patches of cotton are grown north—*just* north—of 40° N. in either area; but the crop does not include one bale fit for power-spinning, and the mass is not fit even for hand-spinning, but only for wadding (clothes, cushions, quilts). And the hand-spun stuff is string rather than yarn.

With regard to Turkestan, the Institute seems to restrict the name to Ferghana, including Samarkand but excluding Bokhara; Kokand, the chief market, is certainly north—35 miles north—of 40° N. But the good Ferghana is practically grown, as the Bokhara and Samarkand cotton is actually, south of 40° N. At the same time, the text (p. 149) says that “the Russian cotton areas are considerably farther north than any others in the world excepting some provinces of China and Korea.” Actually, the cotton grown along the Sir Daria near Kazalinsk is 4° or 5° farther north than any patch of cotton in China or Korea. Even the Transcaucasian (Kutais) and Khiva areas are about 42° N.; so are the Bulgarian areas in the Maritza basin.

The same thing is true of Argentina and the Union of South Africa. The reviewer is not aware of a single acre of cotton south of 30° S. in Argentina. The great export centre of Resistancia—practically Corrientes—is in the extreme south-east corner of the cotton area, *i.e.* the Formosa and El Chaco provinces; so the cotton area is well north of even 28° S. In South Africa, too, there is no cotton from south of the Lower Tugela, *i.e.* the area is well north of even 28° S.

These are, however, slight blemishes to set against all the admirable material given about such matters as the extension of cotton in Korea, Queensland, the Transvaal, etc., or the growing importance of economic factors, especially transport.

L. W. L.

Downland Man.—H. J. Massingham. London: Jonathan Cape. 1926. 9 x 6, pp. xiv. + 246. *Illustrations.* 12s. 6d. net.

This admirably printed and illustrated book contains much information and speculation on topics which would hardly be expected from its title. The stupendous remains at Avebury, the barrows and great earthworks on the Wiltshire Downs and other parts of Southern England, have always excited the attention and wonder of archaeologists. Assuming that each tumulus was the grave of a chieftain, there must have been in the long distant past a great population, and one possessing a considerable civilization. Who were the people responsible for all these great monuments? The archaeologists wonder, and have been content to say we don't know, or vaguely attribute them to Neolithic or Bronze Age times. The author of this book has no such doubts. He is ready with a clear and complete answer to the question. They are the product of that Archaic civilization which has been persistently advocated as the cause of similar megalithic remains in all parts of the world by Mr. W. J. Perry and Professor Elliot Smith. This Archaic civilization originating in Egypt spread thence over the world, even to the Americas. It can hardly have reached Britain later than 2000 B.C., which is a good deal earlier than the date given by Elliot Smith for its progress eastwards to India. The author dislikes the term Neolithic for the period when these great erections came into existence in Britain. He would prefer some such term as Megalithic Age. For the details of his argument the book must be, and deserves to be, carefully read.

From a consideration of this Archaic civilization interesting inferences are drawn regarding the conditions of life of primitive man. The orthodox view that civilization has developed from a state of savagery as the result of strife and war, with the consequent survival of the fittest, is opposed and condemned in unmeasured terms. It is utterly untrue and is responsible for many of the ills from which mankind has suffered, and is still suffering. Primitive man, so far from being a mere progressive savage, imbued with a love of strife, and always ready to engage in it, was peaceful and orderly and unacquainted with war. He cites a number of examples of existing primitive tribes which support

this view, and more than one unbiassed ethnologist has wondered that more attention has not been attracted to these facts before. The rise of war was the result of degeneration, not of progress, a falling away from the peacefulness of the Archaic civilization. The introducers of war in Britain were the Celts, who, so far from being the authors of its megalithic monuments, were the destroyers of its early civilization. The evidence and arguments put forward in this work compel attention and cannot be brushed aside as merely the outpourings of an enthusiast. And every one who feels dissatisfied (and what thoughtful person does not?) with the effects on modern society of war, industrialism, and commercial competition, must be stimulated to serious thought after reading these eloquent pages. Mr. Massingham is evidently a devoted disciple of Mr. W. J. Perry and Professor Elliot Smith, and the latter writes an introduction to the book. It may be doubted whether this is an advantage to it, for it is unfortunate that the learning and ability with which Professor Elliot Smith advocates his views should be marred by a dogmatism of style which deters many from giving them the attention they deserve. Mr. Massingham's own style disarms prejudice, and invites the attention of the reader. At the end of the book a list is given of the authorities used, and also three maps showing The Megalithic Environment of Avebury, Megalithic England, and The Distribution of the Rock-cut Tombs.

E. A. P.

GENERAL

The Changing East.— J. A. Spender. London: Cassell. 1926. 9 x 6, pp. 256. *Illustration.* 10s. 6d. *net.*

In this book the author describes the changing and the changed conditions which he saw in Turkey, Egypt, and India about a year ago. Whilst disclaiming any specialist knowledge of Turkey and India (he was a member of the Milner Mission which went to Egypt in 1919-1920), he brings a very highly trained mind to bear upon three complicated and obscure situations, describing them with a charm and fluency which are at the command of very few travellers.

The three zones under review have a common factor in that for years they have been mixed up with European politics or subject to European control, and that they are now trying by different methods to free themselves from that control. In Turkey, since the destruction of the Ottoman Empire by the war, the replacement of a very mixed population by one which is now practically homogeneous has certainly brought a new element of strength. If Mr. Spender errs in regard to Turkey it is in taking an almost too favourable view of the new *régime*, though he does not hide its shortcomings. Constantinople is the unsolved problem of the new Republic; that place must be a modern city or nothing, and if it is the deliberate policy of the Turk to neglect the former capital, in the long run this will be his undoing.

In about twenty-five pages Mr. Spender sketches the history and politics of Egypt with marked ability. He sees no reason why Egypt should not secure a national status through an amicable arrangement with Great Britain, who must continue to defend her from outside interference. Subsequently he points out the widespread attractions available to tourists, the importance to the country of their coming, and the conditions to be observed by the Government if visitors in large numbers are to be attracted.

The Indian section, which occupies more than half the book, can be but briefly touched upon. In all the great centres the relations between British and Indians struck the writer as friendlier and more human than in 1912.

The influence of Mr. Gandhi is still widely felt, and the Indians receive a great deal of valuable though perhaps unwelcome advice from the writer, whose well-known liberalism and sympathy of outlook give it unusual weight.

In short, for all those who consider that geography in its wider sense should embrace a study of politics and of the conditions of human life, Mr. Spender's book will be an advantage and a pleasure. In it they will find vivid descriptions of three all-important countries and thus increase their understanding of the East, which is changing from year to year if not from month to month.

H. C. W.

The Middle East.— Major E. W. Polson Newman. London: Geoffrey Poles. 1926. 10 × 6½, pp. xvi. + 300. *Maps and Illustrations.* 25s. net.

In no part of the world has the war brought about more fundamental changes or given rise to more far-reaching problems than in the Middle East. Here the Ottoman Empire in its pre-war form has been replaced by the mandated areas of Palestine, Transjordan, Syria, and Iraq, by various independent Arab states, and by a much reduced Turkey. Here, too, whilst some of the conflicting interests of the Western Powers have been gratified, in certain cases international rivalries are more marked than ever. Moreover, the spirit of nationalism, evoked by the war, is another factor of widespread importance.

It is these changes and conditions which give its value to Major Newman's book. Although only professing to describe certain situations and events as they have impressed a journalist, the author has in fact provided a certain amount of historical and local background which enables the reader to understand the developments of which Major Newman has often been practically, if not actually, an eye-witness. Thus in various appendices we find the texts or summaries of the texts of some of the documents which have led to the present territorial distribution of the Middle East, and in several parts of the book there are references to the causes which have led up to present conditions.

The volume is divided into four sections dealing respectively with Palestine, Syria, Transjordan, and Iraq and Persia. The rôle of the British and the positions of the Arabs and Jews in Palestine are discussed, and, whilst somewhat more sympathetic to the native majority than to the Hebrew minority, the author provides the material for an independent judgment of the policy to which the Empire is committed. With regard to Syria, too, Major Newman not only holds the balance fairly evenly between the French and their critics, but he gives what is certainly the best English account of the events which have taken place in that zone since the outbreak of the Jebel Druse Revolt in the late summer of 1925. He has no space to do proper justice to the problems of Iraq and Persia, but the account of his journey to Baghdad and to Teheran is instructive and picturesque.

Although not so serious or comprehensive a treatise as some might anticipate from the title, the book is very readable, and is well provided with photographic illustrations and maps.

H. C. W.

The Ship under Sail.— E. Keble Chatterton. London: T. Fisher Unwin. 1926. 8½ × 6½, pp. 224. *Illustrations.* 10s. net.

The seventeen years which have elapsed since Mr. Keble Chatterton published his 'Sailing Ships and their Story' have been marked, to the regret of most of us, by the virtual disappearance of the sailing ship, at any rate of the large sailing ship, from off the face of the waters; but they have also seen an extraordinary growth of interest, both archæological and artistic, in those fascinating craft in which man first obtained a partial dominion over wind

and sea. The Society for Nautical Research has been in existence now for some sixteen years, and it is the enthusiastic, though perhaps too unobtrusive, work of its members which has enabled Mr. Keble Chatterton to present, in most popular form, a much more precise view of the evolution of the sailing ship than was possible in his earlier book. The author is to be congratulated particularly on his initiative in publishing for the first time three most instructive MS. draughts of late seventeenth-century warships from the Pepysian Library at Cambridge, while the Elizabethan draughts of ships from the same source, contained in Pepys' MS. 'Fragments of Ancient Shipwrightery,' should be of the greatest possible value in correcting those exaggerated notions of the loftiness of sixteenth-century ships to which the drawings of most contemporary artists incline us. Some draughts from the latter MS. have appeared recently in Mr. L. G. Carr Laughton's most instructive and elaborate 'Old Ship Figure-heads and Sterns,' but to have even two of these contemporary scale drawings available in a work at so popular a price, should be of great assistance.

The book is extremely readable, and should do much to keep the romance of sails alive in a generation which can hope to see little of them. Although it deals in the main with masts and sails and their development, the changes which the ages have produced in the hulls of ships and in their methods of construction are by no means neglected.

Mr. Chatterton's comparison between the ships of Ancient Egypt and the Irrawaddy rice-boats is particularly apt, especially as the extraordinary similarity of their rigging has often been obscured by the emphasis laid on the exact resemblance in method of construction between the ancient Nile vessels and those still in use on the Ganges. Page 13 however contains a serious misprint, for Egyptian ships were never clinker-built, but always carvel—plank set above plank without overlap. There is also the regrettable repetition, though in less explicit terms than in some earlier works, of the fallacy that the sails of the Sudanese nugger are or were quadrilateral and descended from the square sail of the ancient Egyptians. The modern nugger near Khartoum has a very triangular lateen sail, doubtless derived from that of the nineteenth-century Egyptian gyassa, while Caillaud, who took part in the Egyptian conquest of the Sudan in 1819, stated quite definitely that sails were then entirely unknown on the Blue Nile, the home of the nugger.

To come to a more advanced period, Mr. Chatterton appears content to accept that in Europe the development of the one-masted vessel, general up to 1450, into the three-masted ship of 1490 as due simply to the demand which increasing tonnage made for greater propulsive power. While the extraordinary advance in sails which took place in these forty years is beyond question, there is little evidence of substantial increase in size, and the sudden evolution of a type of sailing vessel which made possible the discoveries of Columbus and Da Gama and which, without radical alteration, remained efficient for some two hundred years demands, and has long demanded, some more valid explanation. In this connection, it is more than doubtful whether, as the author implies, Prince Henry the Navigator owed any of his successes to the advantages of the square-rigged three-master. It has been generally assumed that his vessels were lateen-rigged carvels, and no evidence of the existence of the three-masted square-rigged ship before about 1466 is at present known.

In his chapter on "Caracks and Carvels" Mr. Chatterton quite rightly points out that the Science Museum model of Columbus' ship is a reconstruction, based on no very exact data, but is he sure that the same criticism

does not apply equally to the fifteenth-century models in the Deutsches Museum at Munich, about which he issues no such warning?

A similar though more important point as to authenticity arises in connection with the author's mention of the "Sovereign of the Seas" model at the Royal Naval Museum at Greenwich. Comparison makes it obvious that that model was made from a draught which may be seen in the same museum, and of which other copies are known. Instead of being contemporary, however, that draught was made about 1817 by a naval shipwright, from sources now quite unknown. Nautical archæology, like all other archæology, was at that date anything but an exact science, and consequently an early nineteenth-century version of a ship of 1637 demands the most critical scrutiny.

"At Sea in the 16th Century" forms a most attractive and breezy chapter, affording the reader real insight into the way of life of the Elizabethan sailors. Another item, for which the many to whom the question has been put should be grateful, is the amusing exposition of the difficulty or rather the impossibility which eighteenth-century authorities, both nautical and legal, found when they endeavoured to differentiate by definition between a sloop and a cutter.

G. S. L. C.

THE MONTHLY RECORD

EUROPE

The Santorin Eruption, 1925-26.

A DETAILED account of the phenomena accompanying the eruption of the volcanic vent of Santorin Island, which began about the middle of 1925 and continued with intermissions well on into 1926, is given by Dr. E. Hermann of Berlin in the *Geografiska Annaler* (Stockholm), vol. 8, 1926, Part 3. It is accompanied by sketch-maps and photographs taken by the author on the spot, and the account is partly based on the reports of Greek observers, Prof. Georgalas, Dr. Liatsikas, and Dr. Perterris, and of the well-known volcanologist Dr. Hans Reck, whose report has since appeared in the *Centralblatt f. Mineralogie*, etc. As is well known, the Santorin group is the remnant of a vast volcano formed in late Tertiary times, whose old crater wall is represented by the imperfect ring formed by the islands of Thera, Therasia, and Aspronisi. In the centre of the caldera, the small islands of Palæa, Mikra, and Nea Kaimeni have been created by eruptions within historic times, the last as late as 1707 A.D. On it was formed in 1866 the volcanic plug known as Georgius, but from that time till 1925 the volcanic forces were quiescent. The new activity began with earthquake shocks on 28 July 1925, but the first explosion was not till August 11. On the 10th the water in the strait between Nea and Mikra Kaimeni became so hot that the fishermen were forced to leave the neighbourhood. By the evening of the 11th the magma had welled up to the surface, and on the 12th spread over the whole channel between the two islands. This first phase culminated about the middle of September, and was marked chiefly by explosive emissions of gas and ashes. A second phase, marked by increased lava-flow, began on October 13 and reached its maximum at the end of the month; while a third, in which both gaseous explosions and lava-flow took place, began on 7 January 1926, and reached its maximum on February 10, activity finally ceasing in May. The lava streams took three directions, one filling up a ravine of the Georgius peak to the south, the other two bending round the ends of Mikra Kaimeni to the north-west and south-

east. The area so covered is well over a kilometre in length. To the east a submarine bank dammed back the lava-flow, while on either side it passed into water 100 metres deep, so that an enormous space had to be filled before the surface rose above the water, and this explains the slow rate of advance of the lava-front, imperceptible to the eye. After the crust had hardened the magma continued to flow beneath the surface, carrying some of the hardened portions with it, the flow resembling that of a glacier. At the centre of eruption a hemispherical plug of half-consolidated lava was formed (traversed by longitudinal and radial fissures) which sometimes rose and fell perceptibly, and the explosive emissions of gas and ashes were both vertical and horizontal. The pictures give an excellent idea of the vast volumes of steam and smoke emitted, sometimes in the form of a cauliflower. Stones were also discharged to a height of 500 metres, and on falling covered the surface with glowing spots of red-hot matter, while flames shot up to a height of 20 metres. The explosions took place rhythmically, ten or more following each other at intervals of about a second. The Greek observers have determined the rock discharged to be hypersthene-andesite.

ASIA

Early Spanish and Portuguese Travellers in Persia.

A paper by Sir Arnold Wilson in the *Asiatic Review* (Oct. and Dec. 1926) gives an interesting account of these travellers from Benjamin of Tudela to Pedro Sebastiano Cubero. Benjamin, though he probably did not actually visit Persia, deserves a place for his account based upon information collected during his stay at Baghdad. He also describes Quais island—the emporium of the Persian Gulf, and the pearl fishing. The later travellers were usually either ambassadors seeking aid against the Turks, representatives of Portuguese trading interests, or missionaries. One of the earliest was Ruy Gonzalez de Clavijo, sent by Henry III. of Castille to negotiate with Timur. In 1403 he voyaged to Trebizond and thence overland to Tabriz and Sultaniya. His long chase of Timur finally ended in Samarkand. On his return journey he visited Bukhara. His important journal was ultimately printed at Seville in 1582. At the beginning of the Portuguese empire in the East, Duarte Barbosa sailed with Cabral to the East Indies *via* the Persian Gulf, of which he gives a valuable account. With the exception of Odoric, he was the first to describe Hormuz, and, though his information on Persia was largely at second hand, his narrative of the rise of the Shia creed is important. With the acquisition by Albuquerque of Hormuz in 1515, Portuguese relations with Persia became closer, if unsettled. An early ambassador sent to regularize if possible the situation was accompanied by Antonio Tenreiro. On the conclusion of the mission Tenreiro left Tabriz in company with some Armenian Christians bound for the Holy Land. Arrested by the Turks at Diarbekr, he was sent a prisoner to Cairo. Finally liberated in a penurious state, he succeeded in returning to Hormuz by the Euphrates valley. In 1529 he was sent on a mission to Portugal, on which he crossed the desert from Basra to Aleppo. The next traveller, Pedro Teixeira is better known. After a sojourn in the East and a journey round the world, he returned to Goa, whence he made his way home by Basra, Baghdad, and Alexandretta. The account of this journey contained in his 'Relaciones' (Antwerp, 1610) "shows real insight and knowledge, equally in history, politics, and geography."

Antonio de Gouvea (c. 1570-1628), an Augustinian, visited Shah Abbas at Meshed on behalf of the Viceroy of India, continued on to Spain by Hormuz, and was then sent back on a further mission to the Shah. Thrown into prison

by Abbas, and impatient with the course of events, Gouvea succeeded in escaping, only to become a prisoner of Algerian pirates until 1620. He mentions another Augustinian friar, Nicolas Melo, who left Isfahan with Sir Anthony Shirley's embassy, but was thrown into prison at Moscow at the latter's instigation. Abbas then expressed himself as "weary of receiving Friars as Ambassadors," with the result that Philip III.'s next representative was Garcias de Silva Figueroa. His mission was not successful, but in his 'Comentarios' there is much of value for Persian geography and customs. The last traveller noted, a priest, Pedro Sebastiano Cubero, reached Persia through Russia and Armenia in 1674. He reached home by Hormuz, Malacca, and Mexico after an absence of nine years.

With the exception of Barbosa and Tenreiro, early editions of the narratives of these travellers are in the Library of the Society, many of them being included in the Hotz gift.

AFRICA

An Eighteenth-century Traveller in Abyssinia.

Among the communications in the fifth volume of the *Compte Rendu* of the Cairo International Geographical Congress is a paper by Father T. Somigli drawing attention to a little-known Franciscan traveller in Abyssinia, Father Remedio Prutcky, of Bohemia. The paper is based upon an unpublished manuscript account of his journey and observations on Abyssinian history and geography, now at Prague. With two companions, Prutcky, on the invitation of the Emperor, set out from Cairo in August 1751. The earlier part of his Itinerary deals at considerable length with Egypt, Palestine, the Coptic church, and other general matters, and goes on to describe his journey from Suez along the east coast of the Red Sea beyond Jidda. He mentions the numbers of the Mecca caravan as approximately 40,000. Crossing to Massawa, which he describes unflatteringly, he had to wait for an Imperial passport, but finally joined a caravan at Gherar on 21 February 1752. The itinerary thence to Gondar is given in detail, and the place-names have been identified by the editor. Prutcky appears to have had some acquaintance with the language. His route lay more or less directly by Asmara through Shire, across the Takkaze to Gondar. Judging from his description, conditions of travel in Abyssinia have not changed greatly. The hostility to travellers, not completely removed by the Imperial passports, the difficulty of obtaining supplies, the native liking for raw meat, the method of crossing the Takkaze on skins stuffed with hay, might be incidents from a modern traveller's diary. He spent nine months in Gondar, but accomplished little, though the hostility displayed to foreigners. Finally, this opposition compelled the Emperor to expel Prutcky and one companion, one being kept to translate some books of the Bible. A considerable part of Prutcky's account consists of a general treatise on Abyssinia—its history, extent, and boundaries of its administrations, military, financial, and religious organizations. The decline of the empire is attributed to excessive centralization, the inefficiency of the autocracy in coping with risings in outlying provinces, and recent prolonged ravages of the locust. Prutcky seems to have been a great traveller, as he had visited India, America, and the greater part of Europe, as well as Palestine, Egypt, and Arabia, before he died in 1770.

Sudanese Drought Problems.

Under the title of "A Famine Zone in Africa: the Sudan" (*Geographical Review*, October 1926) Mr. G. T. Renner, of Columbia University, outlines

the rainfall conditions in relation to human life in that part of Africa, including Nigeria, which geographically is part of the Sudan. It is pointed out that the territory lying between the Sahara and the rainy regions of the Guinea coast and Congo Basin is subject in certain years to an undue encroachment sometimes of the droughty conditions in the north, and at others to the wet conditions in the south, so that the rainfall at particular places is liable to vary enormously from one year to another. In fact, the rainfall is excessively irregular. Even at Fort Lamy, where the rains are usually dependable, there are great variations in the month of arrival of the seasonal rains, and at Talgwareb complete absence of rain in 1913 appears to have been followed by 55 inches in 1914.

But whilst crops may be ruined in wet years, by far the most serious climatic enemy is deficiency of rain, for in a hot country, where the average fall is but slender in relation to economic requirements, the dry years have disastrous consequences. Formerly the droughts gave rise not merely to famines, but to tribal depredations and pestilence, and even now under civilized administrations drought is a serious menace to the development of the Sudanese countries. It is rightly observed that whilst nothing can be done to prevent droughts, much can be done by economic adaptation to dry conditions to minimize their worst effects. There remains, however, the problem of progressive aridity, which, as in other parts of Africa, is strongly suspected to be in operation. In Senegal the encroachment of desert conditions is said to be causing a slow southward migration of the population, whilst in Gambia cotton and cereals appear to be passing out of profitable cultivation. The writer quotes work of Sir H. Lyons correlating variations of pressure over North-East Africa with variations of the Nile flood as an index of rainfall, and produces maps showing the normal wind and pressure conditions affecting the Sudan area as well as those in unduly dry or wet years. Whilst the writer's description of the meteorological facts is excellent his interpretation thereof is misleading. Thus, whilst he is right in showing that the summer rains of the Sudan are as definitely, if not so obtrusively, monsoonal as those of India, powerful air currents being drawn in from the Gulf of Guinea and Indian Ocean towards the seasonal low-pressure area in Northern Africa, it does not follow that the old theory of the northern swing of the equatorial doldrum rain-belt is "entirely unsuited to the facts." The fact seems to be that the moisture-laden monsoon currents from the south are encountered by the dry northerly winds of Egypt and the Sahara, and that the convergence of the two air streams is the main factor in the rainfall, precisely in accordance with the old doldrum theory. It should be realized that the equatorial doldrum belt nowhere at any time exists without more or less local monsoonal modifications connected with the irregular distribution of land and water.

AMERICA

Fur Industry of Prince Edward Island.

An interesting article on the fur industry of Prince Edward Island and its geographic conditions by Mr. F. A. Stilgenbauer is contained in *Economic Geography*, January 1927. This industry, which dates only from 1894, has to some extent compensated for the decline of the island lumbering and ship-building. The fur farms raise foxes exclusively, and practically all are silver black foxes of superior strains. Wild foxes were formerly plentiful in the forests, and the natural conditions on the island, the long severe winter with 83 inches of snow, and a mean February temperature of 18° F., are especially

suitable. The gently rolling topography, securing southern aspect and good drainage for the runs, and the character of the subsoil—for reasons connected with the farming a medium texture surface horizon is most suitable—add to the island's advantages. The severe winter, essential for good pelts, also prevents disease by freezing the food. The proximity of the sea makes a cheap supply of fish and cod-liver oil available, and the general agricultural industry provides meat and offal. After a period of decline during the war, the industry expanded rapidly; between 1919 and 1923 the number of registered farms increased from 252 to 448. These constitute the bulk of the industry, but the total number of farms approaches 1000. The comparative isolation of the island has led to the development of co-operative principles. In the fur industry 142 farms are joint capital concerns. In 1923, 8658 animals and pelts were sold for 1.2 million dollars. Animals are especially in demand, as Prince Edward Island is the leader in the domesticated fur industry. That of Ontario, the second, is only approximately 40 per cent. of the Prince Edward Island output.

The Fairweather Range, S.E. Alaska: Retreat of Glaciers.

The snowy range of Mount Fairweather (15,300 feet) is one of the most imposing features of the coast of North-West America as seen from the sea, but though partially mapped from a distance by the Alaska-Canada Boundary Commissions (the international line running through Mount Fairweather), it has only lately begun to attract the attention of mountaineers. In the summer of 1926 a first attempt to climb Mount Fairweather was made from Lituya Bay (on its outer or western side) by Messrs. Carpe, Ladd, and Taylor, but after a height of nearly 9500 feet had been reached by hard work on a much-crevassed glacier, the difficulties ahead then seemed too great to be overcome with the limited supplies and time available, and a return to the coast was made.

Later in the same summer a more extensive reconnaissance of the range, chiefly from the inland or Glacier Bay side (though with no attempt at an actual ascent), was made by another party of three, consisting of Mr. W. Osgoodfield, President of the Harvard Mountaineering Club, Mr. B. S. Wood, and Mr. W. R. Bonsal. Short accounts of the experiences of both parties are given in *Appalachia* for December last. The second party began its examination, after entering the inland waters of Glacier Bay, by an ascent of Geikie inlet on its eastern side, and of the Geikie Glacier which enters the inlet at its head. By this means a view was obtained over the vast ice-fields of the Great Brady Glacier to the group of peaks in the southern part of the range, culminating in Mount Crillon (12,725 feet). But a careful examination of these peaks with field-glasses showed that no easy route of ascent exists on this eastern face. The scenery is described as marvellous. The party then proceeded north to Tarr inlet in order to examine the eastern side of the northern group of peaks, of which Mount Fairweather is one. The Margerie Glacier, which descends to Tarr inlet from the immediate neighbourhood of that mountain, was found to be so broken with crevasses and seracs as to offer no possible route, and though the Ferris Glacier farther north could probably be ascended (thanks to its moraine-covered surface) to the base of the 10,000-foot peaks around Mount Root, these appear to be so precipitous on this side as to be extremely difficult to scale. The Ferris Glacier winds down through a canyon with walls 4000 to 5000 feet high, the surface having melted down very considerably during the past fifty years, leaving walls little disturbed by subsequent erosion. (May not some instances of "hanging" valleys be due to a similar rapid decrease of the ice in the main valley, a possibility to which attention has been called

more than once in this *Journal*?) Evidences of rapid retreat of other glaciers on this side were also seen. Thus the Grand Pacific Glacier at the head of Tarr inlet has receded a quarter of a mile behind the international boundary, giving Canada access (for the time being at least) to the open water of the inlet. Subsequently the examination was continued from the outer side, facing Lituya Bay, which is described as one of the most beautiful spots on Earth. On this side too the northern peaks seemed to offer no feasible line of ascent, but it was thought that Mounts Crillon and La Pérouse in the southern group might present no insuperable difficulties.

AUSTRALASIA AND PACIFIC ISLANDS

The Dummer Range, Western Australia.

In his report on his journey across Northern Australia, published in the *Journal* for October 1926, Mr. Michael Terry describes (p. 321) a range of low hills which he saw from Mount Cornish at about 30 miles' distance to the west. He estimated that the range, which rises approximately 300 feet above the plateau, extended northwards for about 7 miles. As these hills do not appear on any official survey, Mr. Terry has been authorized by the Lands Department of Western Australia to name them the "Dummer Range" after his home, Dummer Hall, near Basingstoke. Their position is indicated roughly on the sketch-map accompanying his paper in the *Journal*.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Mediterranean Oceanographical Research.

In a monograph entitled "Le Plankton et ses relations avec la Température, la Salinité et la Profondeur," based on the research of the late Prince of Monaco between 1907 and 1924, M. Maurice Rose not only puts on record new facts about the part of the Mediterranean Sea off Monaco, but indicates the lines for future intensive research (*Annales de l'Institut Océanographique*, tome 3, Fasc. iv., 1926). As regards temperature, it appears that during the winter months the water is in a more or less stable homogeneous condition characterized by the slow descent of surface-chilled particles and their replacement by warmer ones from below. There is not however complete homogeneity, for in consequence of differences of salinity, which permits layers of colder water to float above warmer, patches or flakes ("flocons") of thermally unstable water are carried along in the currents, and thus preserve their identity. But during the summer months, particularly when the temperature is rising to a maximum, in addition to the ordinary causes of irregular surface heating by the sun's rays, these *flocons* of thermally unstable water which in winter remain inactive, become centres of perturbation whereby heat is communicated by eddy motion to subjacent layers. Summer is thus the season when the sea surface is thrown into numerous centres of activity, one eddy system being generated as another dies out, and so forth, the depth of the local disturbances varying greatly. The result of the process is that the surface of the sea in summer is thermally discontinuous, containing numerous *taches thermiques* in which the temperature may be several degrees higher than that of the surrounding water. It is thought probable that this seasonal thermo-dynamic cycle is characteristic only of tideless inland seas of the Mediterranean type. Salinity likewise exhibits discontinuities, but such *trous salins* are very superficial and transitory, and not to be compared with the *taches thermiques*. The distribution of plankton is also patchy. The phytoplankton is localized in the surface layers, where it finds the light necessary to its growth and multiplication. The zooplankton

is also most dense in the surface layers, but the fauna, though abundant in individuals, is, especially in summer, poor in species, becoming more varied at lower levels, till at great depth species occur which are never met with at the surface.

Since temperature, salinity, and plankton all show a discontinuous distribution in the sea, the question arises whether there is any close correspondence between the three phenomena. This problem calls for further systematic research into the exact delineation of the *taches thermiques*. The winter months are rich in diatoms, the summer in copepods, there being no diatoms at all after March, and the origin of this apparent inverse evolution of the two types of organism is at present somewhat obscure.

HUMAN AND HISTORICAL GEOGRAPHY

Capt. William Hawkeridge and the North-West Passage.

Of the many voyages in search of a north-west passage in the early seventeenth century there is one—that of Captain W. Hawkeridge—about which our information has hitherto been of the scantiest, depending solely, in fact, on the unsatisfactory account of it given by Captain Luke Foxe in his work published in 1635. Mr. Miller Christy, who some years ago edited the voyages of Foxe and James for the Hakluyt Society, has succeeded, by a careful examination of contemporary records, in bringing to light a good many new facts regarding both the career of Hawkeridge himself and the circumstances in which his voyage to Hudson Bay was undertaken, though our knowledge of the actual voyage is not increased (*Mariner's Mirror*, vol. 13, No. 1, January 1927). Hawkeridge was one of the band of Devon seamen who took a foremost part in exploration in the late sixteenth and early seventeenth centuries, and was probably born at Dowland on the Torridge about 1590. In 1610 he was "servant" to Captain Whitbourne during the latter's voyage to Newfoundland, and was a witness of the appearance of a supposed mermaid. In 1612 he took part in Button's expedition to Hudson Bay. In 1618 he commanded the *Thomas*, one of the East India Company's ships, which took part, with ten others, in the successful fight with a Dutch fleet off Jacatra. After serving the company for several years more with credit, he got into trouble with them on account of irregularities during a voyage home from the East in 1622-23, and though an arrangement was eventually arrived at, his connection with the company was severed in 1624-5.

This left him free to take other employment, and the new evidence shows that his voyage to Hudson Bay, previously supposed without adequate grounds to have taken place in 1619, was really made in 1625. It has been known that in that year Sir John Wolstenholme and his friends projected such a voyage, but it has been uncertain whether it actually resulted. It now appears that Wolstenholme interested the Duke of Buckingham in the venture, and that the latter obtained from King James the grant of the Royal pinnace the *Lion's Whelp*, for the purpose of the voyage. The King's death occurred before the vessel had been actually handed over, but the matter was hurried through under the new king's warrant, and there seems little doubt that the expedition sailed during the summer of 1625. In the hope of a successful passage and return by the East Indies, application had been made in May to the East India Company for assistance from their agents in the East, and after some demur this was promised under conditions. The choice of Hawkeridge to command was no doubt influenced by his knowledge of the Eastern seas, coupled with his previous experience in Hudson Bay. But so far as can be

learnt from the confused account given by Foxe (the confusion may in part have been caused through disarrangement of the "copy" by the printer), the voyage effected nothing in the way of new discovery, for Hawkeridge seems to have spent his time in more or less aimless cruising in Hudson Strait and its neighbourhood without even entering Hudson Bay proper. Mr. Christy is to be congratulated however on having at least fixed the date of the voyage and the circumstances which led to it.

The Introduction of the Potato into Europe.

The somewhat confused history of the introduction of the potato to Europe is disentangled by Mr. W. E. Safford in a paper reprinted in the *Annual Report* of the Smithsonian Institute for 1925, pp. 509-32. He shows that the popular legend that the potato was brought by English colonists from Virginia is untrue. The potato, *Solanum tuberosum*, has been confused with the sweet potato, *Ipomea batatas*, encountered by Columbus, and the "openawk" of Virginia. That the *Solanum tuberosum* became known as the potato was due to a mistake of John Gerard, who in 1597 figured it with the title *Battata Virginiana*, and stated that it grew naturally in Virginia. Through its confusion with the Virginian openawk, *Glycine apios*, the legend arose that it was introduced into Ireland by Sir Walter Raleigh on the return of his colony from Roanoke Island. When it was discovered that Raleigh never visited Virginia, the honour was transferred to Sir Francis Drake. It was later pointed out by Sir Joseph Banks that the sweet potato had at an early date been introduced into the Canary Islands and Spain, and exported to England long before the arrival of *Solanum tuberosum*. Actually, this plant was cultivated in Chile and Peru, but never reached the shores of the Caribbean Sea. It was brought by the Spaniards from South America to Europe, and was cultivated in Ireland before 1663. It did not reach North America until 1719, when it was introduced by immigrants who settled at Londonderry, New Hampshire. No specimens of *Solanum tuberosum* growing wild have ever been found.

GENERAL.

The Total Solar Eclipse of June 29.

In conjunction with the Joint Permanent Eclipse Committee of the Royal and Royal Astronomical Societies the Director-General of the Ordnance Survey has published a special combined sheet of the new 10 miles to the inch map of Great Britain, extending from Glasgow in the north-west to London in the south-east. Overprinted on this map are the curves showing the limits of totality, the magnitude of the partial eclipse outside the totality zone, the G.M.T. of mid-eclipse, and the altitude of the sun at that time. These curves were computed by Dr. L. J. Comrie of the Nautical Almanac Office. The map is contoured and layer-coloured, and a special cover for this edition bears a handsome design showing the solar corona of the type associated with sun-spot maximum, as may be expected on June 29.

In choosing a station for viewing the eclipse one should look for a clear horizon to the north-east, for the eclipse takes place at about 5h. 30m. G.M.T. at an altitude of about 12° ; but one should also look for an extensive view south-westward, preferably over the sea or flat country seen from a height, in order to see the approach of the moon's shadow at about 100 miles a minute. This may probably be seen even if the eclipse is cloudy. The prospects of clear sky at so low an altitude early in the morning are not very great, and there is not much on the statistics to choose between the prospects at stations

in the east and west. The Secretary of the Eclipse Committee recommends sight-seers to keep their plans "flexible" until the last minute, and be guided by meteorological reports issued the evening before the eclipse. Whether they are prepared to take this risk or not, all observers will find the Eclipse Map indispensable in selecting suitable stations. The map is published at 3s

OBITUARY

General Sir Charles Warren, G.C.M.G., K.C.B., F.R.S.

SIR CHARLES WARREN, whose death took place on January 21, had been a Fellow of this Society for more than fifty years, and had served on its Council. He was born in 1840, and was within a few days of his eighty-seventh birthday at the time of his death. His many services to his country as a soldier have been described in the daily Press and it will be sufficient here to mention only the main outlines of his military career. After passing through the Royal Military Academy, he entered the Royal Engineers in 1857; promotion was not very quick in those days, and he did not get his captain's step until 1869. He commanded the Diamond Fields Horse in 1878, and was in charge of the Northern Border Expedition in 1879. He commanded the Bechuanaland Expedition, as a major-general, in 1884-5. He commanded in the Straits Settlements from 1889 to 1894, and the Thames District from 1895 to 1898. He was Lieut.-General in command of the 5th Division in the South African War in 1899-1900.

He was always devoted to geographical studies and to archæology. From 1861 to 1865 he had been employed upon the large-scale survey of Gibraltar. He was appointed assistant instructor of surveying at the School of Military Engineering in 1866; he came back to the same school as chief instructor in 1880, and remained in that post for four years. But meanwhile he had been to Palestine, where he did a remarkable work for the Palestine Exploration Fund. This Society had been founded in 1865; work in Palestine was commenced in that year, by Captain Wilson and a party of R.E., in the form of a rapid reconnaissance, admirably carried out. After Wilson's return to England, the Committee of the Fund obtained permission from the War Office to engage the services of Lieut. Warren, whose experience of practical surveying rendered him very fitted for the work, and who was also known as an officer of great determination of character.

Warren and his party of three corporals landed in Palestine in February 1867 and remained there until April 1870. Warren's explorations and excavations of Jerusalem form an important chapter in the history of archæology. In spite of obstruction of a very trying kind he was able to keep on good terms with the Turkish authorities, and by hook or by crook he got the work through. In particular, he discovered the wall of Ophel, the "gutter" up which Joab climbed when David captured the Jebusite city, the foundations of the sacred enclosure at the south-east corner, now buried in 80 feet of rubbish. He sank shafts on the hill of Ophel and across the Tyropœon valley to ascertain the depth of the rock surface, mapped the course of Hezekiah's tunnel, and was allowed to explore the rock-cut cisterns made for the storage of water in the Temple area, and much else. He settled several vexed questions of site, and amongst them that of the position of the Temple. Early in 1867 he executed a reconnaissance survey of the neighbourhood of Gaza and Askelon.

He retained his interest in Palestine to the last. He strongly supported the renewed excavation of the Hill of Ophel, which was carried out by the Fund in the years 1924 and 1925. At the end of the latter year, when the report on these excavations was being published, he assisted materially in the preparation of the map of the excavations, showing some of the main features of the primitive hilltop fortress which was the Jerusalem of 1000 B.C. He wrote several works on the subject of his excavations: 'Underground Jerusalem,' 1874, 'The Temple or the Tomb,' 1880; the 'Jerusalem' volume of the *Survey of Palestine*. He also wrote a little book on Ancient Weights and Measures, and edited an edition of Frome's 'Surveying' (1873). The cover of the *Quarterly Statement* of the Fund still shows a picture of Warren's great shaft, which was sunk at the south-eastern corner of the Haram enclosure.

On his retirement from the Army he "took up Church Lads' Brigade and Boy Scouts for practical work," as he wrote in a letter a few years ago; and he studied weights and measures as a hobby, particularly with reference to the possible connection of the ancient standards with the English standards. He would sometimes talk of his many experiences; the writer remembers how Warren described staving off an attack of fever in Palestine by staring intently at a mark in the ceiling of the house where he was spending the night, thus, as it were, hypnotizing himself into health! He certainly had determination enough for the feat, if it were possible.

C. F. C.

Dr. R. W. Felkin.

We regret to record the death, at his home in New Zealand on 28 December 1926, of Dr. Robert W. Felkin, a Fellow of forty-six years' standing, whose name has long been known to geographers in connection with the opening up of Central Africa in the latter part of the nineteenth century. On the foundation of the C.M.S. Mission in Uganda as a result of Stanley's appeal, expeditions were sent both from the East Coast and by way of the Nile, Felkin, who went out as a medical missionary, being one of the party which took the latter route, starting in 1878 and reaching Mtesa's capital in February 1879. The journey had been delayed somewhat owing to the obstruction of the bed of the Upper Nile then existing. He was the first Englishman to set eyes on both the great lakes of the Upper Nile. Circumstances compelling his return after a stay of three months only, he again took the northern route, but the river being still blocked, he and his companion, the Rev. C. T. Wilson, made an important journey overland across the whole breadth of the Bahr-el-Ghazal region, then most imperfectly known, from south-east to north-west, striking the Upper Bahr-el-Arab, the main western feeder of the Bahr-el-Ghazal, on its upper course, and continuing north to Dara in Darfur (reached on 31 December 1879), and so to Egypt. Both travellers gave an account of their experiences at an evening meeting of the Society in April 1880. The journey across the Bahr-el-Ghazal was for the greater part over new ground, and a route-survey carried out by the travellers was worked up in Germany by Dr. Hassenstein and published in *Petermanns Mitteilungen* in 1881, with accompanying letterpress.

Felkin was joint author with Wilson of an important work, 'Uganda and the Egyptian Sudan,' which appeared in two volumes in 1882, and was one of the editors of the 'Collection of Letters and Journals of Emin Pasha' (translated from the German by Mrs. Felkin), which came out in 1888. He also contributed various papers on medical and ethnological subjects to scientific journals,

and in 1895 published a small book on the 'Geographical Distribution of Tropical Diseases in Africa.' After residing some years in Kensington he migrated to New Zealand, where he spent the last ten years of his life.

CORRESPONDENCE

Ships of Early Explorers

MAY I be allowed to correct a most unfortunate error which I made in my recent lecture on "Ships of Early Explorers," when I stated that the *Discovery* which accompanied Cook on his last voyage was again used by Vancouver during his explorations along the north-west coast of America?

Although Cook's *Discovery* was still in existence and continued to bear that name, the ship which Vancouver employed was a new vessel, specially bought by the Admiralty for that purpose in 1789, while she was still on the stocks in the Thames-side yard of Messrs. Randall & Brent, and named the *Discovery* at her launch.

Cook's old ship may be found in the Navy List of 1797 as the *Discovery*, tender, 8 guns, Naval Transport at Spithead, and a last glimpse of her may be obtained in E. W. Cooke's well-known engraving of the *Discovery*, convict-ship, lying at Deptford in 1828.

G. S. LAIRD CLOWES.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

Eighth Evening Meeting, 21 February 1927.—The President in the Chair.

ELECTIONS.—Field Marshal the Right Hon. Viscount Allenby, G.C.B., G.C.M.G.; Capt. Desmond Gurney Buxton; Allan Cavanagh Caldwell; William Henry Chinn; Miss Marie B. T. Fisher; Major Wilfred Taylor Fletcher, B.A., LL.B., I.A.; Thomas Arthur Griffiths; Miss Gwendoline B. Howells; Leonard William Jepson; Percy George Murden; Capt. R. North; Mark Pasteur; Oscar Prentice; Malcolm Sarkies, M.R.C.S., L.R.C.P.; Mrs. Charlotte Francis Shaw; Miss Mabel Steedman; Thomas Edward Ward; Joseph Arthur Worsnop, J.P.; Mrs. Ethel Gertrude Woods, SC.D., F.G.S.; Cyril Thomson Young.

PAPER: New Routes on Ruwenzori. Capt. G. N. Humphreys.

Ninth Evening Meeting, 7 March 1927.—The President in the Chair.

ELECTIONS.—George Antonius; Prof. George Brown Barbour; O. S. Bird; N. Robert Bjuke; Charles E. Caley; Capt. J. Callander, A.M.I.C.E., M.I.S.E.; Percy Revell Fairclough, M.A.; Miss Hilda Mary Farley; J. A. Barbour James, F.R.C.I.; Rev. Robert H. Mercer, B.A., B.D.; James Nicolson; Capt. William Albert Norman; Capt. D. M. Penrose; Mrs. Charles Pilkington; Clarence Robinson, B.A.; Capt. K. E. Schweder; Rev. William Solomon; Thomas Gilbert Standing, M.A., L.C.P.; William Thomas.

PAPER: Some Nigerian Contrasts. Rt. Hon. W. Ormsby-Gore.

Fifth Afternoon Meeting, 14 March 1927.—The President in the Chair.

PAPER: The two oldest Maps of China extant. Prof. W. E. Soothill.

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THE DIDINGA MOUNTAINS

J. H. Driberg

Read at the Meeting of the Society, 7 February 1927.

IF I have any claim to a scientific designation, I am an anthropologist, and not a geographer. On the score of geographical science, and still less of geology, I have no sort of qualification to speak. None the less, my official duties and anthropological recreations have led me to remote areas which were previously unknown and which may therefore claim the interest of novelty, and the slight amateur knowledge which I have of elementary surveying has enabled me to supplement my observations with more concrete material.

I should like to lay stress on the fact that I am here dealing with an entirely new country which has not previously been described, and I submit that it is a surprising country to find in the locality. In conditions which should be tropical, for the altitude of the range does not suggest the likelihood of anything approaching temperate conditions, we find a flora which is essentially sub-tropical and even at times temperate. The butterflies of the region perhaps afford a clue, as we find here that the lepidoptera are predominantly of the Abyssinian type as contrasted with the West African type associated with the forests of Uganda. This suggests that the flora found here is an extension of the flora of the Abyssinian highlands, preserved by conditions of climate and altitude long after the intervening area has dried up and become a plain, almost treeless and entirely tropical.

The area with which I deal has no generic name and is known vaguely both to Europeans and to other neighbouring tribes as the Didinga mountains. The Didinga themselves are known by a variety of nicknames to their neighbours, nicknames such as Lango, Toi, and Karoko, and on old maps you find areas thus labelled "Dodinga or Harogo," or some such analogous name. However, they call themselves Didinga and should so be spoken of by us. But, like most African tribes, they have no generic name for a complex of geographical features: their view-point is completely local and analytical, largely owing to the fact

that under normal conditions no one travels beyond his habitual environment, and is thus unacquainted even with adjacent geographical conditions. Even a small range of mountains is not named, though all its most insignificant peaks, valleys, plateaux, or depressions have an individual nomenclature. Just in the same way no river has one name, but every little reach or every pool which remains permanent when the main river is dry has its own name. Thus the Thingaita has a vast and disconcerting multiplicity of names, of which the Thingaita is possibly the best known, being called at various points within a few miles of each other Gilogit, Nathilani, Kovir, Mamtikaburi, Lodiga, and so on.

The nomenclature of the Didinga mountains is further complicated by the fact that formerly all the eastern side of the range was inhabited by the Topotha, who now occupy the plains to the north-east of the mountains. Feuds, cattle plague, and the spread of morskittos led the Topotha to migrate to the plains, not in bulk but in isolated though consistent movements which started many years ago and continued to within the last seven years. One result is that on the east side of the mountains most of the geographical names have been duplicated, and the Didinga now use both their own and Topotha names indiscriminately. Thus we have Taala and Morungoli, the Didinga and Topotha names for the same hill, both meaning "the dappled rocks." Nawiakitela is a Topotha name meaning a broad open space, and is so called by the Didinga. A river rising on Lotuke is called alternatively Kamothing—the Topotha for "the place of the rhinoceros," which abound in that vicinity—or Mamtikngetelak, which is the Didinga version with the same meaning. Nawuruwich, "the place of fat cattle," curiously blends Topotha and Didinga in one word, *uro* being a Didinga word meaning "dust spirals," from dust raised by the cattle's feet, and *owich* being Topotha for a cattle kraal.

Every geographical name has a meaning, and it is the meaning which often enables one to transcribe with accuracy a name which may be loosely or carelessly pronounced or which is with difficulty heard. The selection of a particular geographical name may be influenced by a variety of motives. The name may only contain a geographical description, as do Tola, "The Pass," or Bokorora, "A ridge running out and dividing two adjacent territories": it may refer to some botanical or geological feature or to the distribution of fauna, as Ngorom, "travertine"; Kimodo, "the place of red earth"; Nakólip, "the place of black earth"; Kikelai, "the land of wild olives"; Nakorechoke, "where the giraffe are driven up hill": or again, climatic conditions may determine the name, as for example, Loduru, "the ridge of fog"; Lowákuch, "where it always rains" (derived from the Topotha *Nyakuch*, "rain"): or the name may enshrine or commemorate some ~~clan~~ history or personal experience, for example, Lotuke, which is a ~~clan~~ name; Rubwor, a large

forest named after a dead leader; Karimi, "the place where a man ran away distracted after a great loss"; Chebjya, "where a calf was tied to a tree."

The general aspect of the Didinga mountains is fairly straightforward. Extending from Irum in the north to Lothulia in the south, they form



Sketch-map of the Didinga mountains

one continuous geographical feature, narrowing in places, as for instance above the limestone caves of Ngorom near the west of Lotuke, to an elevated neck, at times no wider than 20 yards, from which extend at irregular intervals alæ of varying lengths: farther north the central plateau broadens and the alæ lose their independent character, and are involved in the general complex which forms the Didinga range. Hard

angularities give place to rolling downs, crag and scarp, shale slope and barren rock to rounded crystalline contours, fertile meadows and deep pastures. The east continues to exhibit features similar to the south, intensified in abruptness, steeper and more rugged; while the north-east is a series of sheer precipices and deep gorges, the traversing of which involves considerable exhaustion and is sufficiently precarious in foggy weather to make even the native mountaineers cautious in their generally reckless movements. Only on the central plateau do we find a paradise of subtropical climate and vegetation, from which at a general altitude of 6000 feet we can survey the barren Topotha plains in the distant east and look westward across the scarcely less arid Kidepo valley towards the Nyangiya mountains some 35 miles away.

The contrast between the eastern and the western sides of the range is immense. On the east, as I say, precipitous cliffs and sheer escarpments drop suddenly to the general 2000-foot level of the plains, which are broken and irregular: on the west the descent is gradual and the main mass of the mountains is approached by a series of foothills. The west is better watered and carries a greater quantity and variety of vegetation; the east is arid and clearly shows the effects of contact with general eastern conditions: the vegetation is stunted and almost exclusively tropical of the type usually associated with savannah country. The crest of Lotuke and all the higher plateaux are heavily forested, as are the majority of the gorges, differing only in the nature of the vegetation, which on the highlands is of a temperate and semi-temperate variety, such as cypress, *Wellingtonia*, and beeches, whereas in the gorges palm trees predominate and enormous timber trees, particularly mahogany and cordia. A large variety of edible fruits abounds, notably a species of cherry, an edible *viringia*, blueberries and loganberry canes. The distribution of bamboo is worthy of notice, being found in the vicinity of Lotuke, at Kibongorok and Ngalam and on the north-east side of the mountains; elsewhere, though conditions appear to be the same, it does not exist. Shortly after the spring rains start a large variety of flowers burst into bloom, and the country is blue with a carpet of gentian, the forests become heavy with the scent of cyclamen, and the rhododendron colours the landscape with a profusion of blossom: then, while the grass is still short and the days are cold and, as often happens, heavy with mist, and the bracken is green and dripping with moisture, one might easily forget that one was in tropical Africa and be transported in imagination to the enchanting hills above Edinburgh.

Geologically the area is of considerable interest, recalling as it does the inverted strata of the Jura region. It has clearly been subjected to a succession of great upheavals, and to this day the line from Taala to Ngorom and thence to the south end of the Nyangiya range is affected by earth-tremors of varying intensity. During the month of the Japanese earthquake in 1923 over thirty shocks were noted, but none outside of



Mount Lotuke from Bokorora



Kawara rocks on Taala plateau



North-west foothills of Didinga and Buthi peak



Crystalline limestone of Taala



Reach of the Lovinga

this line. On one occasion, while I was climbing Taala during this period, a violent tremor, which lasted for close on two minutes and was succeeded by a number of lesser tremors, was preceded by a terrific rumbling and a roaring so ominous that I was myself apprehensive, and the natives who were with me were prostrated with panic and unable even to run away. During the main tremor large masses of rock were detached and precipitated to the plains, and the ground swayed and reeled in a most disconcerting manner. I may mention that the ascent at this point was steep and difficult, and the crashing of *débris*, the noise, and the apparent instability of the mountain created an impression which was the reverse of pleasant.

That this region is one which has always been subject to earth-tremors is established by two Didinga legends, but I should add that the arrival of the Didinga at their present habitat is comparatively recent, and these legends must enshrine a tradition handed on to them by previous occupants of this territory.

The first refers to Taala, a rocky eminence of crystalline limestone at the east end of the south arm of the Laudo valley. It rises abruptly from the plain to a height of 5615 feet, and the crest of it resembles a battlemented terrace—rocky turrets embracing a small plateau of fertile land. Two limestone caves revealed no trace of any earlier culture, and water is obtainable from a spring near the summit and from other springs lower down should, as rarely happens, the topmost spring dry up. In the dry season however the water is not sufficient for all requirements, and livestock has daily to be driven down to the hot springs of Mamtikaburi, which bubble continuously in the bed of the Thingaita river at the base of Taala. The water of these hot springs is highly impregnated with sulphuretted hydrogen, and contain so large a proportion of solids that it is not really fit for human consumption except for limited periods. I should add that the limestone at the top of Taala is of the crystalline variety, but at the base it has become metamorphosed into a marble. An interesting point is that by crushing the limestone crystals obtained at the crest strong fumes of sulphuretted hydrogen are released, though the water now obtained from the topmost spring, Ngamunyunyi, contains no trace of this gas.

The story runs in this way : " Once upon a time Tadoi quarrelled with Nakapel " (two turret peaks on the crest of Taala), " for Nakapel asserted that he was better dressed than Tadoi. ' Observe,' he said, ' my beautiful green grass and how fine my limestone is, all white and shining in the sun, so polished and resplendent that all the girls fall in love with me and my heart rejoices ; for it is good to feel the green grass about one and to catch the eye of the sun and to know love. But I am sorry for you, Tadoi, who are only black rock.' At this time both Tadoi and Nakapel lived at Taala, and they quarrelled as to who was the greater, but Nakapel thought that beauty was the more important thing and did

not care to be great or important. Tadoi however would not leave him alone, as Tadoi was jealous and said that beauty was nothing, and that Nakapel was growing old and his limestone was crumbling away from him, whereas Tadoi would never grow old, and, though his rock might be black and uncomely, yet it endured and would continue to endure long after Nakapel ceased to interest the girls. And so they quarrelled perpetually until in the end Nakapel said, 'If you persist in saying that you are more important, I shall go away to a new place.' He used to live on the south of Kawara" (another of the turret peaks of Taala), "but in his anger he plucked himself up and he went. There was much dust and smoke and an unceasing rumbling for three days when Nakapel went, and he went north to where he now is at the Loruth river" (9 miles away). "He went and dropped little hills by him, which are the little hills which we see to-day near Loruth, and the river Loruth sprang up, for there was no river before, and that is why its water is always warm and brackish. Nakapel went with all his cattle and goats: he still has them all, but we cannot see them as he has hidden them away somewhere. We know that this is true, as there were people here in those days, some way farther back down the valley, but they were too far from Taala for any to be hurt."

I may remark here that any river or spring in this part of Africa which is called Loruth or Naruth, or a similar name—and there are many of them—may be accepted as brackish without sensory evidence. This connotation of the word is common to many tribes such as the Topotha or Turkana in addition to the Didinga, and is a useful indication of what a traveller may expect to find at the end of a hot and thirst-provoking march.

The second legend refers to a hot spring, Kanangorok, on the Dodoth track to the south-west of Lotuke. There is ample water here at all seasons of the year, and during the dry weather both livestock and game drink from it freely. Though the pond is only just above normal heat, the spring is itself almost unbearably hot at its point of issue.

"A Lotuke man"—thus runs the story—"went to waylay Dodoth, and on his way across the plain found a small pot resting against the branch of a fig tree which was beside the track. There was some rain-water inside the pot, and the lightning spirit had entered in with the rain and had adopted the pot as his home. The spirit was away at the time, but discovered that this man had taken the pot, for after returning from his walk the spirit found that the pot had vanished and followed on the tracks of the man who had taken it. The whole sky immediately clouded over, and a terrific storm gathered. Now the man who had taken the pot thought that it was only an empty pot, and if he had known that it was the home of the lightning spirit he would not have taken it. So when the man saw the storm coming up behind him, he ran homewards without thinking much of it. He ran and he ran, but the faster he ran

the more the storm concentrated on his tracks. The rest of the sky was clear and sunny, but the menacing clouds gathered behind him, whirling great columns of dust, and came gyrating in great spirals after him. Then he knew fear, for he could see that the storm was shaped for him alone, and he thought that this must be God, and he threw the pot away at the place which we call Kanangorok. The storm stopped where he threw the pot, and it rained there for four days without ceasing. But the pot broke when he threw it and the water in it was spilled. So the spirit came to live there, and it became the boiling spring of Kanangorok, where formerly there had never been any water."

These two stories, I think, may reasonably be taken as a tradition of at least seismic activity in the past, and the former may even contain a tradition of now long-forgotten volcanic action. But before passing from the subject of springs I must first refer briefly to two springs, Longorina near Nagichot and Benyangoli near Malala. My attention was first drawn to Longorina by sounds of what appeared to be rifle-shots, but on investigation I learned that no shots had been fired, and I discovered by inquiries from the local Didinga that the sounds emanated from Longorina, a spring hidden in a dense thicket of the forest fringing the source of the river Ngamyela. This spring is greatly feared, partly owing to these sounds and partly owing to a belief that supernatural lights play about it, and no Didinga will go near it except in the dry season, when the water and the surrounding marsh disappear.

Longorina is greatly feared and respected, but the fear which it inspires is nothing to the horror which even the name of Benyangoli evokes. I heard of its existence by a mere accident, and it was only two years later that any one could be induced to show me even where it was situated. When I asked for information about Benyangoli, I would generally be told quite courteously and with an expression of disingenuous candour that there was no such place, or that it was a creation of my own imagination. Further questioning would plunge my listener into an abject terror, and it was only gradually that I was able to learn the mythical attributes with which its history had been embroidered. Benyangoli—I was told—is a spring at the bottom of a deep gully: it is cursed, and no living thing goes near it. Once a herd of buffalo approached the spring and died incontinently, and ever since then all animals have avoided it, so that there is never seen the track of any animal in its vicinity, while cattle by instinct keep at a safe distance from it, and no human being will approach anywhere near it. Birds even do not fly over it, and if any fly too low they suddenly drop dead and disappear. Lights constantly flicker over the spring, and it emits loud detonations from time to time, and there is always a roaring gale of wind blowing from it, so powerful that at times it will even drive cattle before it. Such are the legends which have grown round Benyangoli, and which have terrified successive generations of Didinga. It was difficult and, as I

say, a matter of two years to find any one willing to guide me, as they firmly believed that I would die if I were to visit the spring, and they were courteous enough not to wish my death ; but eventually I was able to persuade a few men to do so on the understanding that it was my own responsibility and on condition that I should first undergo every kind of magical prophylactic. The approach was curious and hesitating, as my guides wished to stop and turn back every few yards, and to return to the group which was anxiously watching our progress from a safe distance. We reached the deep gorge in safety, and then had to negotiate a belt of nettles shoulder high and entered the forest. Beyond this point my guides would not go, but by signs and whispered directions indicated the route which I should take, as the spring was now close at hand. The side of the gorge was very steep, and the going much impeded by roots, lianæ, and a tangle of undergrowth. But in any case I advanced with possibly unnecessary caution, as I was not sure what to expect, though marsh gas offered an easy explanation—and I may say now that it is probably the correct explanation of the phenomena connected with these two springs, though a sample of water which I took from Benyangoli for analysis unfortunately never reached its destination intact. However, I shortly arrived within sight of the spring and was relieved to see that it was not so lethal as tradition asserted, as butterflies were hovering over it and some geese were contentedly swimming in it. Thus reassured, I tripped over a root and rapidly ended my journey to find myself sitting before the most beautiful pool imaginable, surrounded by maidenhair fern and backed by a wall of pegmatite, marvellously smooth and exquisitely tinted, over which a cascade of clear water fell into the muddy catchment of the pool. The darkness of the surrounding forest only threw into greater relief the small patch of sunlight which filtered through a break in the treetops on to the mysterious Benyangoli. The place was too beautiful for a rational explanation, and I am sure that, though they saw me return unharmed, the Didinga will not abandon their old fears and Benyangoli will not yet be desecrated by the trampling of cattle and the ruinous voracity of goats. Sporadic explosions of marsh gas will still continue to maintain the truth of the old legends, and the incident will only be remembered as an instance of incredible good fortune and as an example of the efficacy of protective magic.

On the mountains the average rainfall is approximately 48 inches a year, with a dry period in December and January and a lesser break in July, May and June providing the heaviest fall. What happens to all the water which the mountains collect is a question which will naturally occur. In what direction does it drain and what use, if any, is made of it? The answer to this question should be easy, but I fear that I am somewhat hampered by lack of personal experience of the country farther north, say between the 7th and 8th degrees of north latitude. All the rivers in this vicinity are seasonal as soon as they leave the hills. In the

mountains themselves there is an abundance of perennial springs and streams, and the larger gorges contain flowing water near the source at all seasons of the year, but this water frequently disappears into the sand and gravel, reappearing, it may be, a few hundred yards lower down until it finally disappears for good. During the rains most of these gorges are quite impassable for days at a time, and a vast volume of water is carried to the plains. On one occasion I recollect that I took four very moist and unpleasant days on a journey which would normally be completed in one long march. On another occasion when, towards the end of the rains, I camped by a river-bed near the entrance to the Thuguro valley, I found it interesting to observe the action of the stream which was running down quite strongly, as I camped at the point of its then disappearance into the sand. From midday to six o'clock in the evening the stream had receded between 40 and 50 yards, but in the cool night air it had by the next morning recovered more than half its loss.

If we return to our map we see first on the east the valley of the Kidepo, called by the Didinga Lokido, or "The River," meaning that it is the most important river for them. Its importance lies in the fact not only of its danger during the flood season and the difficulty of negotiating it when in full flow, but also in the fact that the Didinga are semi-nomadic, and all the western half of the tribe depends on the permanent pools of the Kidepo, such pools as are formed by the gneiss barrier at Katukwi, for their dry season's quarters. They migrate in mass with all their livestock and settle for two or three months on its banks in order to obtain fresh pasturage for their cattle, to be within striking distance of game, and to enjoy the fruit of the borassus palm which abundantly fringes the Kidepo wherever water is permanent.

It is very obvious even without personal experience that the Kidepo, rising near Morungoli behind the Didinga range, must carry down annually a tremendous volume of water, not only from its Didinga tributaries, but also from the Nyangiya mountains through the Naruth valley and from the Acholi country by the agency of its most valuable feeder, the Moratori. The Kidepo, after bending round the Dongotono hills, pursues a steadily northward course, gathering to itself all the water which comes down from the west side of the Didinga mountains, until its bed gradually widens, loses definition, and finally disappears north of the Longarim hills. These hills are not drained by the Kidepo, but by a smaller, though still quite considerable river when in flood, which we shall call the Lovinga from its best-known reach, its main sources being the Morukwa and the Iwochi on the south, while north of Lomongoli it receives a further addition in the Kothowan, which rises in a delightful re-entrant of Chawa, the most northerly point of the Longarim hills. This Chawa has been the site of innumerable battles between the Longarim and the Topotha, and I have never seen graves so closely clustered together in Africa as at this place, nor funeral cairns so elaborate

and lofty as some that are visible on all sides at Lokanangorok. The source of the Kothowan itself affords an abundant supply of water at all seasons of the year, even when other supplies fail; but once again at no great distance north of Lomongoli the Lovinga disappears into the prevailing cotton soil, and the waters lose themselves in a marsh during the rains.

Of a similar nature to these rivers is the Locherekinyatom, which rises on the north of the Didinga mountains and runs close along the east side of the Longarim hills, and shortly after being joined from the east by the Lokulan and its affluences loses itself in the sandy region north of Bobolech. All these rivers are impassable when rain is falling heavily in the mountains, and throughout the rainy season they carry a constant flow of water, but during the dry season, though they are generally dry, water can be obtained by digging to no great depth at fairly frequent intervals; and at many places rocky barriers form permanent pools, sometimes so large as to carry an abundance of fish, albeit of a muddy nature which only the general absence of fish enables one to eat with satisfaction. This is one point about the mountain streams which is difficult to understand, and that is the total absence of fish in all the rivers except the Komoju on Mount Lotuke. It is not that the water is insufficient, nor that the temperature is too cold, as the lowest night temperature which I recorded was 41° F. at an altitude of 4870 feet, and I am unable to account for the phenomenon except on the hypothesis that the annual floods have carried all the fish down the waterfalls on to the dry plains, where they have only survived in a few pools, as at Mamtikaburi, and whence they have been unable to return. It is not however for this cause, but for a more esoteric reason, that the Didinga refuse to eat fish, which are in some way associated by them with their high god, and are called in addition to their ordinary name "the lightning of the river" and "the spirit of the river." Indeed, all rivers and watercourses are to a certain extent feared for the same cause, and Didinga will not normally spend a night in close proximity to a river—even if the bed is dry and it is not the season for floods—for fear of some evil or sickness befalling them by too close a contact with the supernatural. The prohibition against fish therefore seems to be due to their association with rather than their absence from rivers.

To the north-east of the Didinga mountains lie the barren Topotha plains, arid, hot, and quite unattractive. Save along the river-banks the country almost entirely consists of black cotton soil, which during the rains clings to one's feet and makes walking a matter of infinite toil, and during the dry season entirely fails to retain any moisture and opens out into gaping cracks often large enough to trip one up. Grass is scanty and of such poor quality that the Topotha rely more on palm fronds for thatching their huts, and the prevailing vegetation consists of stunted thorn trees which grow in thickets and belts so impenetrable that a long

détour is not uncommonly necessary to avoid them. Browning gives a better description of this desolate country than any which I could put before you :

“ I think I never saw
Such starved ignoble nature; nothing throve;
For flowers—as well expect a cedar grove!
But cockle, spurge, according to their law
Might propagate their kind, with none to awe,
You'd think : a burr had been a treasure trove.

* * * * *

“ If there pushed any rugged thistle-stalk
Above its mates, the head was chopped—the bents
Were jealous else. What made those holes and rents
In the dock's harsh swarth leaves—bruised as to baulk
All hope of greenness? 'tis a brute must walk
Pushing their life out, with a brute's intents.”

This country is traversed by two main rivers which run north parallel to each other, the Thingaita and the Lokalyan, the former rising in the mountains overlooking the Laudo valley and the latter rather farther south. Almost connecting the two is a small tributary of the latter, the Anakankaka, and we find the whole population of the extensive Topotha tribe settled along the banks of these three rivers in a series of villages which sometimes, as between Karengak and Mothingo on the Thingaita, extend for several miles without a break. Here they live during the rains, depending for food largely on their extensive herds and but little on the white millet which their women cultivate in small quantities, as during the rains, at any rate from April to August, the mountain floods bring down such an abundance of water that even when the floods have passed the sand is so saturated that a slight scratching on the surface suffices to produce enough water. As the dry season approaches however these river-beds, in which the sand is so deep that any reefs or bars are too overlaid to act as reservoirs, cannot maintain the population, and all except the old men and some women and children, with a modicum of warriors for protection, migrate with their livestock and chattels to a variety of permanent pools in the Didinga foothills, as at Loruth, Kataninyang, and Lopurwi, or in the Longarim country, such as Marit and Kothowan, or even as far as the Kidepo; for one has to recollect that often permanent water which during the rains is useless for watering livestock owing to the prevalence of tsetse fly, during the dry season is free of that pest. The earlier surface scratchings in the drying river-beds have now become deep wells, and by the end of the dry season these wells are often 40 feet deep, with steps cut in their side and branches inserted as supports in order to enable relays of women to pass the water out. The few cattle which have been left to support the residue of the tribe are strictly rationed with a daily water allowance, cleanliness is not encouraged, and appalling skin diseases, such as one never finds among the mountaineers, affect the whole population, while the conditions are

so favourable to the guinea worm that *filaria medinensis* has become one of the commonest complaints. The banks of all these rivers are lined with borassus palm, the fruit of which is much prized; but the Topotha population is so great and the demand so far exceeds the supply that the fruit is collected at night and privily hidden in secret caches to foil would-be thieves. It is one of the most delightful sights imaginable on a moonless night to watch hundreds of torches flickering up and down the river-banks as the women and children hunt sedulously for the fallen fruit, all singing and in good humour, but all distrustful of each other and determined if possible to get the better of each other by trickery or even, if necessary, by blows.

The Thingaita river loses its definition at Kamojonget, spreading out into a marsh of cotton soil in which grows a small forest of acacia trees, but I have no personal experience of the Lokalyan north of Lakorechoke, though I am informed that this river also disperses itself before reaching Kathiangor. North of Kathiangor, in the country lying between the Beir and the Boma plateau, the whole country becomes a marsh during the rains, and rather farther north remains a marsh throughout the year. It is not unreasonable to assume that the tremendous volume of water which is every year precipitated from these southern hills reaches this marsh subterraneously, as the cotton soil is too absorbent to carry the water along the surface, and thus finally, after many vicissitudes, reaches the Nile.

An exception must be made in the more south-easterly area, including the Bokorora valley and the whole region between the Didinga range and Mogila. Though one would expect the drainage in this area to follow the same northerly course, for there appears to be nothing to prevent it, the general lie of the land has here acquired a more definite tilt eastward, and the Kebekenyang with other minor rivers suddenly swings round east and passing the north point of Mogila continues eastwards towards Lake Rudolf.

This region well illustrates the general desiccation which is creeping over Africa, and the traveller requires to know his country and to exercise caution, as water is extremely scarce and any disappointment might entail grave difficulties. Old village sites and tribal traditions clearly indicate that at one time Mogila was thickly inhabited. Now there is nothing but secondary vegetation, very sparse, thorny, and stunted. Grass is scarce, and large tracts of sand and gravel indicate the spread of desert conditions which must inevitably extend still farther westward unless steps are shortly taken to reafforest the area. In this context I may perhaps be permitted to refer to a historical tradition of the Lango tribe, who used to live in this region in the sixteenth century and to the best of my knowledge have had no recent experience of the country. When I was among them about ten years ago, they described among other geographical details of their former habitat a hill which they called



Lomongoli re-entrant from western plains and Lotyathe peak on right



Kibongorok from the north-east



Permanent pool Iwochi on seasonal river Lovinga



Forest cleared for cultivation at source of the Mula



Thorn scrub on Topotha plains



Longarim foothills

Morukau. Apart from the verbal similarity—*Moru* not being an essential part of the word, but meaning "hill"—their description of the geographical features was so accurate that I was able to identify the hill definitely as Kaiywe, a limestone range of hills which lies to the east of the Didinga mountains. Their description, in fact, was so accurate that I was able without much difficulty to find the only possible route by which one could pass from the west to the east side of the hill, or rather range of hills, a route which it would otherwise have taken some days to discover owing to the complicated nature of the terrain. This, to my mind, is a most interesting piece of evidence of the value of old historical traditions the literal accuracy of which is often needlessly impugned, and if we add that among the reasons why the Lango migrated from this area were famine and the gradual failure of their old sources of water supply, we can see that the process of desiccation, accompanying the gradual elimination of what must have been a once heavily forested country, has been going on for centuries and is still going on, thanks largely to the destruction of timber for which Africans and Europeans are alike responsible. When the Lango migrated there were still several permanent pools at Kaiywe; now there is abundant water during the rains, but during the dry season often there is no water at all, and only one pool can occasionally be relied on to provide water for a small party for a few days.

So far we have not spoken of the Didinga who inhabit this area, and it is impossible within a limited compass to do more than indicate very cursorily what an interesting people they are; nor do I wish to incur the rebuke that native tribes are not geography, though often they are culturally dependent upon geographical environment. And yet this environment acts in singular ways which are frequently unaccountable except on the ground of cultural conservatism. At Lotyathe, for instance, there are extensive deposits of iron ore, which are worked by the neighbouring Napore, who with the Lokathan provide the bulk of the metal implements used by the Didinga, while the Didinga, in whose country this excellent ore is to be found, know nothing about metallurgy, and with the exception of one old man, Ngolikoti of Dokoich, show no interest in what would be a valuable trade, and no disposition to learn it. The earlier inhabitants of the hills, possibly some member of the Lotuko-speaking group, were very obviously workers of metal, as they have left several indications, notably at Kikelai and Telech, that they used to smelt the ore and put it to a useful purpose. Yet despite the ocular evidence of slag heaps, and despite the skill of some of their neighbours, the Didinga continue to regard metallurgy as one of the banausic arts and definitely refuse to avail themselves of the opportunities which their environment affords.

They are a pastoral people, owning extensive herds of cattle and

goats, herds which once upon a time were far more extensive than they are now, but even at this time quite considerable. Probably their own cattle were originally of the short-horned, humpless type, small but very thick-set and scaling about 600 lbs. dead weight, but numerous raids have introduced the large-horned, humped type which is common to their neighbouring plainsmen, and though the former still predominate the two strains are clearly discernible, together with a third variety which is due to interbreeding, and which, while it tends to reproduce the main features of the original stock, has resulted in greater weight but an inferior yield of milk. Didinga culture largely centres round their cattle, resembling in this respect the cultures of the Dinka on the one hand and of the Masai-Topotha group on the other, but they have a great advantage over other tribes which are predominantly pastoral in the excellent and varied grazing which their country affords them, and in the climatic conditions which are ideal for cattle raising, as well as in the possession of two varieties of stock to an extent which is beyond the resources of other native pastoralists.

But once again environment has interfered, and we find that climatic conditions, an unusually fertile soil, and their economic relations with their neighbours have induced the Didinga to take an interest in agriculture which is far beyond that shown by other pastoralists. In this accommodation to their environment the Didinga have shown themselves to be like their highland kinsmen of the Boma plateau who live rather farther north on the Abyssinian border: but in contrast we find that the adjacent Longarim and the Beir living in the Pibor river, who are also their kinsmen, are content with the most primitive agriculture, and with a bare sufficiency of grain crops, owing to the climatic conditions under which they exist and the general meagreness of their soil.

While the technical appliances of agriculture are equally primitive among the Didinga—until quite recently, for instance, they used digging sticks of hardened wood and had not adopted any form of hoe—their general knowledge of agriculture is surprisingly great. They know, for example, the part played by bees in fertilization, a piece of information not elicited (as one might imagine) by direct inquiry, but offered voluntarily in explanation of a poor harvest in a year when rain and fog had caused serious destruction to the wild bees. While they have not the art of terraced cultivation as have the Lotuko, nor any knowledge of irrigation as have the Lango of Logoforok, they have naturally enough an intimate knowledge of soil values as evidenced by the wild vegetation, and are able to distinguish, for example, a lime-saturated soil by the presence or absence of particular trees. Unlike most native tribes, when grain grows too thickly they transplant the seedlings to fill up gaps elsewhere, and in their variety of grain they show a sound botanical knowledge and hotly argue the relative values of the different species of millet, not only from the point of view of the flavour and

nutriment to be derived from flour of different species, but also from the point of view of relative productivity. Their knowledge must of course be empirical, which accounts for the passion with which one individual will defend a particular species decried by another. They grow two main crops, with subsidiary smaller sowings, and it sounds almost incredible that of the rain millets generally grown there are thirty species distinguished by name and favoured according to the locality, while of the dry-season millets over twenty varieties are known to me, again individually named. Contrary to expectation, which would presume that the rain crops would be grown on the hills, and the dry season's crops in river valleys where water might be expected to collect, the dry season's crops are grown on the tops of the downs and on the higher declivities; and after the end of the rains, by which time the seedlings should be strong and healthy, the crop depends entirely on night dews and on the subsoil water which is ensured by reasonably good rains during the previous months. The value then of the seasonal rivers to which I have already referred is obvious, not only their value to the Didinga who cultivate the rain crops in the valleys and foothills along the river-banks, but even more to the plain-dwellers like the Longarim and Topotha, who rely on the silt brought down annually from the fertile mountain soil to cultivate the few crops which local conditions allow them.

In another direction environment has modified the methods of their neighbours, and we find an entirely different technique of hunting adapted to the nature of the terrain. The method normally adopted by their neighbours is to surround the game with hunters, nets, or fire, and then to kill whatever animals fail to break through the cordon. With the Didinga, however, the nature of the ground prohibits the use of these methods on the hills, as the ground is far too broken and intersected by ravines and gorges to allow any cordon to be effective. Consequently their technique largely consists of driving, and in respect to the hunting of larger game like elephant and buffalo there are certain very definite spots to which the herds are driven. Such a place is Kathawa near Kikelai, and both elephant and buffalo are driven in herds from a distance, even from as far as the Kidepo, and by shouting and adroit manœuvring are induced to enter a bottle neck and plunge over a rocky gorge where they are rapidly despatched. This method of hunting, though it requires fortitude, skill, and courage, is undoubtedly very destructive of animal-life, and partly accounts for the absence of the larger species of game from the mountains, though in this destruction the Didinga spearmen have certainly been assisted by hunters from Abyssinia armed with rifles. Consequently by now elephants and buffalo have both disappeared from the mountains, though bones indicate that at one time they must have been as numerous as they still are in the plains and foothills; I do not suggest

that they have been exterminated, but that they found conditions so unpropitious that they left the mountains and joined plain herds. One venturesome buffalo returned to the hills a few years ago and continues to live in the dense bamboo forests of Kibongorok, but with this exception no survivors of either species now inhabit the highlands.

Who the Didinga are it is difficult to say. There is a tradition that they arrived at the mountains from the south-east, travelling south of Lake Rudolf. They were accompanied by the Longarim, who refused to live on the Didinga hills, as they thought them too arduous and inhospitable, and after essaying the Ngarait range, which they found too deficient in water, occupied instead the Longarim hills and foothills to the north. Farther north again we have the Beir living on the Pibor river and in intimate touch with the natives of the Boma plateau, their own kinsmen. These are all Didinga-speaking people and claim an identity of culture and tradition, though apart from a few individuals they have not met for very many generations. Their legend is the same, except that they travelled north of Lake Rudolf, and it is clear that they had one common origin in the east. There is a recognized trade route between the Longarim and their kinsmen the Beir, which passes by Lopit hill, and it is exceedingly interesting to note that on the north point of Lopit hill there is one Beir village and one Longarim village, permanently settled there as a meeting-point for tribal visitors proceeding in either direction—a most interesting example of primitive organization to deal with environmental difficulties.

Whatever be their origin, however—and their language, which is unlike that of any of their neighbours though it bears a structural resemblance to Masai, suggests a distant Semitic origin—they are a most interesting tribe which presents many abnormal features, suggesting a clash of cultures between possibly Semitic and Hamitic groups. And it is their environment again which has done them a good turn and saved them from complete destruction, as they are a small tribe numerically and, together with several other small tribes who inhabit neighbouring ranges and appear to be distinct in language and culture, could not possibly have survived the change and chances of savage life except for the natural protection afforded them by their hills from the inundating hordes of dalesmen who have swept through them, surrounded them, and left them isolated islands of alien culture; and it is this same environment which, having saved them, has by their remoteness and inaccessibility preserved their old traditions and culture on the one hand, and on the other made them more versatile than their more numerous and powerful assailants. It has given them a greater power of adaptation, and enabled them to make more use of their resources, while they have developed an experimental outlook without prejudicing their traditional ceremonies and customs. More than any African people whom I know they have adapted themselves to their

environment, and more than most Africans they have attained to a philosophic attitude and to an appreciation of beauty and of the realities of nature.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH, said : Mr. Driberg, who is going to speak to us to-night, is already known to those who read the *Journal*. He has served for some years as District Commissioner in the extreme south of the Sudan, that region where the Sudan marches both with Uganda and with the Kenya Colony. The district is very remote and known to very few. The nemesis, as far as we are concerned, is that which always pursues real exploration in very out-of-the-way parts of the world, that is to say, that with the exception of the paper-reader himself we can hardly find any one who even knows where the district is, still less anybody who has been in it. I can only say that I, having been supplied with a proof copy of the paper, went through five pages of it before I began to have a glimmering of the precise part of Africa with which the paper-reader was dealing. Finally, I came upon the blessed name of Lake Rudolf, which is, after all, remote enough ; and when I read of certain rivers running east to Lake Rudolf I knew upon which side of the lake the district about which we are to hear was situated. It is very interesting for us to hear some one who has been in a district so remote, and I think you will find, as you listen to Mr. Driberg and see his views, that it is a district of remarkable variety and of remarkable interest. I will ask him now to read his paper.

Mr. Driberg then read the paper printed above, and a discussion followed.

The PRESIDENT : As I said earlier, I am afraid no one present has actually been in the region of which we have heard, but I believe Major Stevenson-Hamilton knows the surroundings of it, and I will ask him to say a few words.

Major J. STEVENSON-HAMILTON : The extremely interesting lecture to which we have listened to-night deals with the least-known portion of what is probably the least-known part of the British Empire, that is to say, the Sudan. The Sudan has one feature peculiar to itself. Approaching the Equator it is natural to suppose that the climate will gradually become warmer. In the Sudan the opposite is the case. In the north there is dry, hot, sandy country, where the thermometer goes up to 120° in the shade ; towards the south exist swamps (the sudd), and these again give place to the sort of country about which we have heard to-night, well watered, hilly, with a temperate climate, in which it is possible, although nearly on the Equator, to grow European garden produce. To the traveller coming south for the first time, it is very surprising to find this state of things.

Though connected with the administration of Mongalla Province for several years, I cannot claim to know much about the Didinga country from first-hand knowledge. It is only of recent years that the civil administration has taken it in hand. In my day the tribes were perforce largely left to fight and kill each other as they pleased. Parties of Abyssinian hunters used to arrive annually and take up their quarters at villages. They would hunt elephants, raid all round, and depart eventually with slaves and ivory. Before leaving they would deposit a certain number of rifles or other firearms with their hosts, instructing the latter to collect a good supply of ivory, which they would return and remove the next year. Though British territory, it was impossible for the Sudan Government to do anything to stop such practices. It is therefore very satisfactory to learn that we are now administering the country.

There is no doubt in the past that part of the Sudan was a great migration area, through which passed tribes coming from the south. It is very interesting to note the connection between the Didingas and the Beirs in the north. The Acholi, who live to the west of the Didinga country are very closely allied to the Kavirondo tribe of Lake Victoria in Kenya and to the Shilluks, who live north of the Sudd. These three tribes are very widely divided in distance, and separated by many others having no connection with them, and yet their languages are so alike that they can all understand one another. The tradition of the Shilluks and of the Acholi is that they came from the south a few hundred years ago. In the past there was no doubt a great deal of migration, mainly from the south. Possibly the hill tribes represent the weaker peoples, and the plains people the stronger invaders.

The lecturer touched on the deforestation of Africa. There is no doubt at one time the continent must have carried a great deal of forest, similar to the Congo forests of to-day. Native cultivators cut away at the edges of the forests to make room for their crops. They use the tree ash as fertilizer. They plant and reap for two or three successive years. Then the soil becomes exhausted—for it is never manured—and they must seek a new place. Accordingly, they cut down a little more timber. Thus it can be readily understood that in a hundred years a big hole is made in these forests, which never grow again, because as the young trees show themselves they are eaten off by the goats of the natives, and this, combined with the annual grass fires, effectually prevents any of them coming to maturity. Primary forest, having once been destroyed, cannot grow again under existing African conditions. Its place is taken by stunted fireproof secondary growth, containing many acacias, and trees of no great value. One of the deficiencies of the otherwise excellent scheme of afforestation which is taking place in most of our African dependencies, is that it relies almost entirely on exotic trees, and not enough trouble is taken to grow the finer trees of the country. The reason is that exotics grow much quicker and that their economic value is therefore greater than that of the indigenous timber, which is usually slow growing. It seems a great pity, because some of the native African timber is magnificent, and I am afraid a lot of it is going to disappear on account of exploitation without replacement. I remember going over an excellent Government nursery where were grown many exotic and rubber trees, and I asked whether they were rearing any of the fine mahoganies which were growing in the adjoining forest, and at that time were being cut down wholesale for trading purposes. I was informed that there was only one young mahogany tree growing in that great nursery.

Then regarding what the lecturer said about the Didinga not caring about fish as food: I find that most interesting, and it shows how careful one must be never to generalize regarding native habits. He gave it as his opinion that these people were averse from fish because they live near rivers. Now, generally speaking, natives who live near rivers are almost amphibious, and look on fish as the mainstay of their diet, *e.g.* the Riverine Dinkas of the Bahr-el-Gebel.

The PRESIDENT: The fact that there is nobody else upon whom I can call is an indication of the novelty of what Mr. Driberg has been saying. All the names which ran so glibly off his tongue were heard by me for the first time. I do not know whether he realizes how unknown that region of which he was speaking is to an audience in this country. We are very much more ignorant than he thinks. It is proof of how wide-flung the British Empire is, that within it lies a region which is still absolutely unknown to an intelligent audience like

that gathered here to-night. However, in all seriousness we are grateful to Mr. Driberg. As he said at the commencement of his lecture, he is an anthropologist rather than a geographer, and he appeared to think that what he had to tell us about native races was not really what we wanted to hear. May I point out however that, after all, Man is rather a remarkable feature of landscape, and that the distribution of races and peoples and languages in regions as unknown as the Didinga mountains is very good geography indeed. Further, a great deal that Mr. Driberg told us half apologetically, as though it was only suitable to an Anthropological Society, was really exceedingly good meat for this Society. As for his pictures, they were far better, in my opinion, than he prophesied. Quite a number of the photographs were exceedingly good as photographs go upon a screen. But I wish he had told us a little more about them. I think he relied a little too much upon their being exactly coincident with certain things he was saying. That never quite happens. With just those very slight points of criticism, I venture to say that we have had an extremely interesting evening, and that I, for one, have learned a great deal. I believe that Mr. Driberg proposes, when he has finished his service under the Sudan administration, to lead an expedition back into that country and to study the anthropology of it as a labour of love and no longer as a matter of official routine. That is a laudable plan for any man to entertain who has gone through what he has endured.

THE LANDFALL OF COLUMBUS: AN OLD PROBLEM RE-STATED

Lieut.-Commander R. T. Gould, R.N.

Read at the Afternoon Meeting of the Society, 14 February 1927.

ABOUT two o'clock in the morning of Friday, 12 October 1492,* Christopher Columbus, who had left Gomera, in the Canaries, steering westward into the unknown Atlantic, on September 6, and had seen no land since, sighted in the moonlight, from the poop of his flagship the *Santa Maria*, the shores of a low island some miles ahead, and knew that, whatever trials Fate might have in store for him, he had made history, and that the dream of his life was a dream no longer.

The island, which he named San Salvador, and of which, a few hours later, he took possession in the names of Their Most Catholic Majesties, was undoubtedly one of the Bahamas; but its identification with any known member of that group offers a problem which has perplexed geographers ever since, and which cannot even now be said to have been absolutely resolved. In fact, one result of a prolonged controversy has been, I suggest, a gradually strengthening conviction in the minds of geographers that, to speak in mathematical language, a rigorous solution of the problem is impossible; that, as in the case of Euclid's twelfth axiom, the available data, when scrutinized, implicitly forbid the attainment of such a solution.

* Old Style. By the Gregorian calendar it becomes October 21.

If seven cities, so we are told, contended for the honour of being Homer's birthplace (as eleven, certainly, have disputed that of Columbus himself), at least five widely separated islands of the Bahama group have at different times been put forward, and their claims to be regarded as the only true landfall of Columbus strenuously advocated, by various eminent authorities. None of these solutions is free from objection—in one or two cases grave objection—while on the other hand there is something to be said for each. That is, of course, nothing unusual. There is something to be said for any of the score or so of men who have been accused of having written the 'Letters of Junius,' just as there was for each of the thirty-odd unfortunate gentlemen who, between 1800 and 1850, claimed to be Louis XVII. The present problem, however, is less complicated than either of these vexed questions—less complicated, indeed, than even the comparatively simple one of identifying Hannibal's Pass over the Alps. I have said that a rigorous solution is impossible, owing to the conflicting nature of the data; but I hope to show that if one accepts the principle of assessing the value of the various solutions by the percentage of evidence which one is compelled to disregard in each particular case, it is not difficult to pick out one solution to which there attaches a very high degree—an outstandingly high degree—of probability.

As I mentioned, the subject has been repeatedly discussed by many eminent geographical authorities; and, as I have no new theory to put forward, I should have hesitated to address you upon it if I had not felt that it might at least be useful to compile a summary of the facts and opinions relative to the problem, and so to make them more readily accessible. It may also be suggested that the past history of the controversy rather indicates that it actually handicaps a writer on the subject to identify himself with any particular theory; most of them have shown themselves far more convincing when demolishing each other's theories than when defending their own—and, with one pronounced exception, their common defect has been, I suggest, a decided lack of impartiality and balanced judgment.

The historical facts in connection with the various identifications of the landfall are, briefly, as follows:

Beginning from the earliest date at which it can be said that the cartography of the Bahamas was anything more than rudimentary, the island first claimed as the landfall of Columbus appears to be Cat Island. This identification was suggested by Catesby in 1731* and by Knox in 1767,† and held the field unchallenged until 1793, when the learned Spanish historian Munoz put forward the claim of Watling Island.‡

When Navarrete published, in 1825, his classic work upon which all

* 'Natural History of Carolina.' 1731.

† 'New Collection of Voyages and Travels.' 1767.

‡ 'Historia del Nuevo Mundo.' Madrid, 1793.

subsequent investigation of the subject has necessarily been based,* he propounded, for the first time, the theory that Columbus' landfall was Grand Turk Island, and this was supported by his American translator, Kettell, in the Boston edition of 1827, by the Hon. George Gibbs in an article (containing arguments of much greater length than depth) in the *Proceedings* of the New York Historical Society, 1846, and by R. H. Major in the first edition of his 'Select Letters of Columbus' (London, 1847).

On the other hand, the Cat Island theory was revived and strongly advocated in Washington Irving's great life of Columbus (avowedly based in large measure upon Navarrete), which appeared in 1828. Irving, with his customary good sense, entrusted the discussion of the landfall to another hand, only referred to, in the first edition, as "an officer of the navy of the United States" who preferred to remain anonymous—although in the revised edition of 1848 he was revealed as Commander Alexander S. Mackenzie, U.S.N. The claim of Cat Island, in opposition to Navarrete's Grand Turk Island, was also supported, at about the same period, by De La Roquette in the French translation of Navarrete (1828), and by Baron de Montlezun,† while Humboldt‡ also lent the weight of his European reputation in support of the arguments adduced by Mackenzie.

The claim of Watling Island, which, as already remarked, had originally been put forward by Munoz in 1793, and had since lain dormant, was revived and strenuously advocated by Capt. A. B. Becher, R.N., Assistant Hydrographer of the Navy,§ in an extensive work published in 1856.|| To him is due the presence, on Admiralty charts Nos. 761 and 2579, of a note against Watling Island—"Landfall of Columbus, Oct. 1492"—and also an unfortunate error in the ascription of two names on adjacent islands, to which I will refer presently.

One of the principal advocates for Grand Turk Island, R. H. Major, was converted by Becher's arguments (a rare event), and in the second edition of his 'Select Letters of Columbus' (London, 1870) and in our *Journal* for May 1871, he retracted his former views, and accepted Watling Island as the landfall. Becher was also supported by Oscar Peschel in a work published in 1858.

By this date, then, there were at least three Richmonds in the field—Cat, Grand Turk, and Watling Islands—all with a respectable array of advocates; and there was also a fourth, Mariguana Island, put forward

* 'Coleccion de los Viages . . .' Madrid, 1825.

† 'Nouvelles Annales des Voyages . . .' Paris, 1828.

‡ 'Examen critique de l'histoire . . . du nouveau continent.' 1837.

§ This post had not then been officially established, but Becher performed equivalent duties.

|| 'The Landfall of Columbus.' London, 1856. Some correspondence between Becher and Gibbs (already referred to as an advocate for Grand Turk Island) appears in the *Nautical Magazine* (founded and, at the time, edited by Becher) for March 1858.

by Varnhagen in 1864.* This theory, so far as I can discover, has never been endorsed by any other authority of standing; and the same remark applies to another, developed with great diligence and wealth of detail by Capt. G. V. Fox, U.S.N., in a monograph published in 1882.† He selected Samana Island as the landfall. It should be added that his essay forms probably the most complete and scholarly (although also, I think, the most obviously biased) investigation of the subject extant, and on points of detail it is a perfect encyclopædia of information.

Capt. Fox's conclusions were very ably and convincingly criticized by Lieut. J. B. Murdock, U.S.N., in a paper published in 1884 (after the former's death). This is by very far the most competent and impartial examination of the question which I have been able to discover. Murdock concluded that Watling Island was in all probability the true landfall, but he pointed out grave defects in the reasoning by which Becher had previously arrived at the same conclusion.

The subject was also discussed at length by Sir Clements Markham in his 'Life of Columbus' (London, 1892). He adopted Murdock's views, giving at the same time a *résumé* of the other theories. His treatment of the question, however, was not altogether satisfactory. As Macaulay might have done, he wrote, apparently, with the sole object of implanting in his readers' minds the same settled conviction as he had formed himself, and his presentation, both of the facts and the arguments, is in consequence extremely one-sided, as well as being inaccurate in many points of detail. In the edition of Columbus' journal which he edited for the Hakluyt Society in the following year he abandoned argument and treated the identity of the landfall with Watling Island as a *res adjudicata*.

In addition to Markham's 'Life,' referred to above, the fourth centenary of the landfall saw the appearance of three books of first-class importance in the bibliography of the Admiral—Asensio's monumental biography, Harris's 'Discovery of North America,' and Fiske's 'Discovery of America.' Of these the first-named author is in favour of Cat Island, although he prints an appendix in which the case for Watling Island is ably advocated by Juan Ignacio de Armas. Harris and Fiske content themselves, as do Winsor (1890) and Thacher (1903),‡ with a *résumé* of the various theories.

It should be added that the navigation of Columbus' first voyage was very ably discussed by the late Earl of Dunraven in an appendix to the second volume of Filson Young's 'Columbus' (London, 1906). He did not, however, attempt to identify the landfall, but assumed that

* 'La Verdadera Guanahani de Colon' (Chile, 1864; Vienna, 1869.)

† Report of the Superintendent of the U.S. Coast and Geodetic Survey, for the year ending June 1880, Washington, 1882. (Appendix 18, pp. 347-411.)

‡ Thacher refers to an expedition financed by the Chicago *Herald* for the purpose of identifying the landfall. Presumably, so far as that powerful organ's public is concerned, the question is settled.

it was Watling Island. It may, in fact, be fairly said that since the appearance of Becher's work in 1856 the Watling Island theory has gradually made more headway, in the opinion of geographers in general, than any other, and that it is now accepted by the majority, as well as in most standard works of reference. It is, however, open of course for any one to propound a new theory, or to champion an old one, and it will be useful here to take stock of the materials on which such theories must be based, and of the general lines on which the problem can best be attacked.

The original journal of Columbus, and the map which he is believed to have drawn to accompany it, are lost—probably irretrievably. The sole first-hand authority for the voyage which has survived is a lengthy *précis* of the journal, with verbatim extracts, in the handwriting of Bishop Las Casas, the historian of the Indies.* It was examined by Munoz, and published by Navarrete in his 'Coleccion de los Viages . . .' previously referred to. Many English translations of the portions relevant to the present inquiry have been made at different times—by Kettell, Becher, Thomas (for Fox), Montaldo (for Murdock—a revision of Thomas's), Markham, and others. In the present paper I have followed Montaldo's version, which, after collating it with several of those instanced, I believe to be the most accurate.

No other contemporary account of the voyage has survived,† and the *précis* published by Navarrete must in consequence be regarded as the sole real authority for its events. It is therefore very unfortunate (although, in the circumstances of its production, not altogether surprising) that some of its statements, to which I will refer later, are obscure, if not actually unintelligible.

Contemporary first-hand maps, also, are almost entirely wanting. The nearest approach to one is the famous world-map of Juan de la Cosa, a companion of Columbus in his voyage (he was pilot and owner of the *Santa Maria*). It was drawn eight years after the landfall, in 1500. Measuring about 5 feet by 3, it necessarily shows the Bahamas on

* The date of this MS. cannot be exactly fixed. Las Casas completed his 'Historia de las Indias' in 1561, and died in 1566. There is some ground for believing that he worked from a copy of Columbus' journal, and not from the original.

† Some years before the War there were produced in Germany a number of what purported to be facsimile reproductions of that lost copy of Columbus' journal which he is known to have jettisoned (during a storm off the Azores) when returning to Spain from his first voyage. It is difficult to believe that they could ever have seriously been intended to impose upon any but the half-witted. The text, based on Las Casas, is written in a pseudo-Gothic semi-cursive hand, and in *English* (in my copy), the reason alleged for this being that Columbus had intentionally kept this "secret journal" in a foreign tongue. I believe that this hoax was published simultaneously in several countries, the language employed for the text being varied accordingly.

The book also contained what purported to be a facsimile of Columbus' commission as Admiral, and was appropriately bound in brown paper, decorated with sea-shells, pebbles, algæ, etc.

a small scale, and not very correctly; still, it gives a surprisingly good general idea of the group, and has, I think, been somewhat unfairly criticized. Becher, for example, speaks of it as ". . . an old document that is not worthy to be called a chart. . . ."*

Many other post-Columbian world-maps of course are extant, but they are nearly all on such a scale as to be of little value for the identification of "Guanahani," the native name of Columbus' landfall.

One map however, although produced a century later than de la Cosa's, is of great importance. That is the map of the Bahamas given in Herrera's 'Historia General de las Indias Occidentales' (1601). Herrera was the official Spanish historian of the Indies, and had access to all available official documents. It is possible, as I hope to show, to identify Guanahani from this map, and from de la Cosa's, with some certainty.

Apart from the above documents, there is little of fundamental importance in the way of material available, although, of course, much is to be learned from a study of the working out of the various theories and the arguments used for and against them. As regards local information and tradition, little is to be gleaned from this source. The gentle and unsuspicious natives who inhabited the Bahamas at the time of Columbus' arrival were, unfortunately but perhaps excusably, unversed in civilized warfare, and were in consequence rapidly and completely exterminated, leaving the islands swept and garnished for their subsequent exploitation by pirates, bootleggers, high-jackers, and other predatory animals. One or two of the native names ascertained by Columbus are still in use, and assist in the identification of some of the islands which he fell in with, but there appears to be no reliable tradition, either in the Bahamas or in Spain, which throws any light on the subject of the landfall. In fact, such tradition as exists has a directly confusing effect—for example, the name "San Salvador" has, since the beginning of the seventeenth century, been applied at various times both to Cat and Watling Islands, and the resulting confusion formed the subject of a well-meant Act passed by the Bahaman legislature only last year.

No relics, inscriptions or records which can be definitely associated with Columbus' landfall have been found on any of the Bahamas, nor does he appear to have taken any astronomical observations of its position—in fact, Las Casas' *précis*, as a whole, contains remarkably few of such observations. A small number of observed latitudes (some of which are obviously wrong) are given, but the earliest of these is dated 30 October. Even if available, Columbus' longitude of Guanahani would be practically valueless as a means of identification, both by reason of his primitive methods and of his well-known underestimate

* The best reproduction of the Bahaman portion of this chart which I have seen is that given in Harrisse's 'Discovery of North America' (Paris and London, 1892, opp. p. 91). It should, however, be remarked that the accompanying note "Enlarged twice the original size" is incorrect. The actual enlargement is trifling—about 10 per cent.

of the length of a degree; but an observed latitude of the landfall would have been of considerable assistance.

The methods which at first sight would appear to be available for investigating the question of the landfall are as follows:

1. By working up the courses and distances sailed by Columbus between Guanahani and his last known point of departure—Gomera.
2. By using the direct evidence afforded by the charts of de la Cosa and Herrera.
3. By comparing the description of Guanahani which Columbus gives with that of the various likely islands as they exist to-day.
4. By constructing, from the data given in the journal, a plotting of the relative bearings and distances of the various islands discovered by Columbus, and fitting this in on a modern chart.

Before applying any of these methods, the following notes upon one or two general points may be useful.

The courses, bearings, distances, and dimensions given in Columbus' journal are, of course, only approximate. One could hardly expect them to be otherwise. He had no hand-log, and his dead-reckoning must therefore, even when unfalsified, have been quite sketchy, while the distances and dimensions of the islands which he sighted are probably no better than rough eye-estimates. The allowance, if any, which he made for leeway (which in the ships of his time was very considerable) is nowhere mentioned. His courses and bearings appear to have been given to the nearest two points; at least, while he occasionally logs intermediate points such as N.N.W., he does not employ bye-points. His distances are generally given in round figures, and mostly in leagues. Capt. Fox, in the monograph previously referred to, made a careful investigation of the probable values of Columbus' "league" and "mile," and reached the conclusion, which appears well founded, that no great error would be occasioned in calling the "league" 3 nautical miles, and the "mile" three-quarters of the present nautical mile. He also published in the same work a very careful investigation by C. A. Schott (U.S. Coast and Geodetic Survey) of the probable amount of variation obtaining in the Bahamas in 1492. This showed that, in all likelihood, such did not exceed a quarter of a point westerly.* In view of the approximate nature of Columbus' bearings and distances, therefore, it appears best to treat them as being "true," and to convert all quoted distances to nautical miles. While on the subject of distances, it is interesting to note that Columbus frequently speaks of short distances as "two lombard shots," or "two cross-bow shots." The lombard was a species of culverin—a smooth-bore cannon of small calibre and short range.

* Becher found it necessary, in support of his views, to assume that the variation was a point and a half westerly, but there seems to be absolutely no justification for this assumption.

I have not succeeded in obtaining conclusive evidence of its carrying power, but there would probably be no great error in regarding a "lombard shot" as two cables, and a "cross-bow shot" as half a cable.

The first method, that of working up Columbus' run from Gomera to the landfall, is impracticable. The great circle run from Gomera to the nearest point of the Bahamas is about 3100 miles, and at this distance the whole chain of the Bahamas, from Bahama in the N.W. to Grand Turk in the S.E., would subtend an angle of only about 11° ; in other words, even if one could depend upon having worked out Columbus' "course made good" to within half a point, which is a much closer degree of approximation than one could reasonably expect from such data, one would still have all the Bahamas to choose from, while to identify any particular island with certainty one would have to be able to depend upon the "course made good" being correct to about a quarter of a degree—a total impossibility.

The second method—that of using the direct evidence afforded by the charts of de la Cosa and Herrera—is more promising, although not altogether conclusive in the results which it affords. As already stated, while de la Cosa's chart is, for its date, surprisingly accurate in the general idea which it affords of the Bahama group, it is woefully inaccurate in detail. Broadly speaking, it indicates that Guanahani is a comparatively small island, standing out a little to the N.E. from the general N.W.-S.E. line of the Bahamas and towards the centre of that line, approximately due northward of the strait dividing Cuba from San Domingo, and due eastward of the N.W. point of Cuba.

On Herrera's chart, which supports this inference, the Bahamas are indicated with more precision, while in addition all the islands at present known to exist are shown (de la Cosa's chart is defective as regards the N.W. islands). The topography of Herrera's chart is markedly inaccurate, but the *relative* shapes and sizes of his islands are not far from the truth, although their general trend, considered as a whole, has an anti-clockwise error of about 15° .

If we accept the evidence given by the charts of de la Cosa and Herrera, which is in essential concordance, there are *prima facie* grounds for immediately non-suiting two claimants out of our "Big Five"—Cat, Watling, Grand Turk, Samana, and Mariguana Is. For on both charts we see Samana, Mariguana, and Guanahani shown as three entirely separate and distinct islands. It has, indeed, been argued at length by Fox that the name "Samana" was, at the date of Columbus' discovery and for some time after, applied to one of the Crooked Islands, while the present Samana was Guanahani. His arguments are ingenious, but little more. On the other hand, the position given for Samana by Herrera is admittedly very incorrect—much more so, relatively speaking, than that of any other island on his map.

Both charts, moreover, combine against the claim of Grand Turk.

If this were accepted, we should have to assume that all the islands shown by both de la Cosa and Herrera to the south-eastward of Guanahani were figments of their imaginations—an assumption which a glance at the modern chart will show to be untenable. A reasonable deduction, it is suggested, from the evidence of the charts is that they show only two admissible hypotheses—namely, that Guanahani must have been either Cat Island or Watling Island, the probabilities being greatly in favour of the latter.

I turn now to the third method—that of attempting to identify Guanahani from the description of its topography, etc., recorded by Columbus. That description, briefly, is as follows. It was an island of moderate size, low, well wooded, with abundance of water and fruit, having no high hills, with a very large lagoon in its middle, and encircled by a reef. One side trended to the N.N.E., and Columbus especially noted a peninsula which, as he remarked, could easily be fortified.

The Bahamas, which have a total area of about 4400 square miles, and contain some 700 islands and cays,* may be thought to offer a tolerably wide field to any one who, on the evidence of this somewhat vague description alone, should set out to identify the island to which it refers. But, as I hope to make plain later, any one who puts forward a considered theory as to the location of Columbus' landfall is morally bound, or so it appears to me, not only to select an island corresponding with this description, but also one from which Columbus' track—so far as this can be made out from the fragments of his journal preserved by Las Casas—and the islands and cays discovered along that track, can be brought into reasonable agreement with the topography of the Bahamas as at present known. This condition practically reduces the necessary comparisons to the "Big Five" of which I have already spoken.

I take this opportunity of referring to a suggestion which has several times been mooted; namely, that our troubles in identifying the landfall of Columbus possibly arise from volcanic or other extensive changes which have taken place in the Bahamas at some date between 1492 and the beginning of the nineteenth century, by which time their topography, chiefly as the result of work done by H.M. Surveying vessels, had emerged from the comparative twilight of "sketch surveys" and other dangers to navigation, and was known in all essentials as it is known to-day. Such a theory is, of course, impossible satisfactorily to disprove, or even to dismiss as highly improbable: the calamity of Martinique in 1902 goes to show that volcanic disturbances on an almost unparalleled scale have before now given the West Indies a dreadful eminence in the history of seismology; but at the same time we should,

* These figures are taken from the recent 'Maps of the Bahamas: published by authority, 1926.' This work states that "the island officially known as San Salvador is generally called Watlings (*read* Watling), and is now accepted as the island called San Salvador by Columbus."

I suggest, follow Newton in saying *hypotheses non fingo*. If a matter can be cleared up without the aid of suppositions which, however possible, are highly improbable, we have no right, on an ordinary estimate of probabilities, to invoke them. The volcanic changes which would destroy the general outlines of the topography of the Bahamas, or which would, in other words, allow us to "re-mould it nearer to our heart's desire" in respect of some particular theory, would connote an alteration in general level of many yards—and in support of such a sweeping and Wegener-like assumption there is, so far as I am aware, no evidence whatever.

Let us, therefore, turn to the question of comparing the description of Guanahani given by Columbus with that of the "Big Five" as contained in the Admiralty Sailing Directions and other standard sources of information.

Cat Island is roughly 40 miles long N.W. and S.E. by about 10 miles wide at its S.E. end. Its maximum height is about 400 feet.* At the S.E. end (the end likely to have been examined by Columbus) are a number of lagoons. It has no fringing reef (it should, however, be noted that such a reef would in all probability have suffered very extensive changes between 1492 and, say, 1830) and no pronounced portion of coast-line trending N.N.E.

Grand Turk is low and has large lagoons and an encircling reef. On the other hand, it is exceedingly small (only about 2 miles long by 1 mile in breadth), no portion of its coast-line runs for any distance N.N.E., and it has no woods, and no peninsula.

Watling Island is 13 miles long by about 6 broad. It has a very large lagoon at its centre, and is extensively wooded. The greater portion of its eastern shore runs N.N.E. and S.S.W., and it is low, nowhere exceeding 140 feet. It is also encircled by a reef. On its eastern side is a narrow peninsula, forming a natural breakwater to a moderate-sized harbour.

Mariguana Island is 23 miles long, east and west, and from 2 to 6 miles broad. It has no real lagoon, but a few small coastal ponds, the largest about 5 miles in length and, as they all are, very narrow. It is low-lying, nowhere exceeding 100 feet. Its S.E. extremity has a short coast-line, some 5 miles in length, running about N.E. and S.W. It has no fringing reef; on the other hand, there is a well-defined peninsula halfway along its northern coast.

Samana Island (also called Samana Cay and/or Atwood's Cay) is about $8\frac{1}{2}$ miles long by $1\frac{1}{2}$ miles broad. It runs practically E. and W.,

* Markham, in his 'Columbus', p. 95, remarks, "Guanahani was low; Cat Island is the loftiest in the Bahamas." It is undoubtedly true that Cat Island is slightly higher than its neighbours, but quite imperceptibly so. All alike are very low-lying, and "lofty" seems a somewhat misleading term to apply to an island 40 miles long, and nowhere rising more than 400 feet above sea-level.

and has no eastern side at all. It has no lagoon or fringing reef, and no peninsula.

Let it be noted that the absence of all or any of the "stigmata" is not necessarily a conclusive proof or disproof of a particular claim.* Much may have happened in four centuries: a lagoon may have formed or filled up; erosion may have converted a peninsula into an island, or accretion rendered it an indistinguishable part of the neighbouring coastline; a belt of timber may have widened or withered. At the same time since, by the rules of probability, it is unlikely that all these causes should all have operated in the same direction in any one case, it is to be inferred that the fairest estimate of the relative merits of the five claims is to be arrived at by comparing the present facts with Columbus' description without making any allowance for subsequent changes, whose amount and extent it is quite impossible to ascertain or even to estimate.

If we do this, the account will run as follows: Watling Island complies with all the requirements; after it, in order of minimum rejection, come Mariguana, Cat Island, Grand Turk, and Samana.

Finally, we come to consider the information, with regard to the location of the landfall, afforded by the descriptions which have survived, in Las Casas' *précis*, of the relative sizes, shapes, distances, and bearings of the various islands seen by Columbus.

After leaving the landfall the Admiral, who had, he records, made up his mind to pass no island without taking possession of it, visited in turn three other islands, and then, after sighting a group of small islets, fell in with a fifth island, much greater in size than any of the remainder. This island was undoubtedly Cuba.

There is sufficient information available in Las Casas' abstract of the journal to construct a rough charting of these islands, but certain assumptions are necessary, and there are one or two defects of importance. The fifth island, as I remarked above, was undoubtedly Cuba, and the fourth and third can be identified with a fair amount of certainty. The second is more doubtful, and, unfortunately, although we are given the distance of the second from the first—the landfall—we are not given its bearing.

It has been generally assumed, even by the usually very careful Murdock, that the second island bore S.W. from the landfall, this assumption being based on the fact that Columbus stated, in his journal for Saturday, October 13, that he intended to sail, on the following evening, S.W. in search of other islands. But as evidence to his actual course this is entirely negated by a statement, in the journal for the following day, that having set sail he saw so many islands that he did not know which to make for first, but that he finally selected the largest.†

* So far as one important feature, the lagoon, is concerned, there is another island, Great Inagua (21° N., 73½° W.), which can compete with any of the "Big Five." I do not, however, envy the lot of any one who endeavours to work out a consistent track for Columbus from Great Inagua to Cuba.

† His masthead height may have been 60 feet. From this elevation Cat Island (400 feet) would have been visible some 30 miles.

Actually this statement is very obscure, for it does not seem possible that from any position in the neighbourhood of his probable landfall he could have seen any such archipelago as he describes. Possibly, but not probably, he was misled by clouds hanging over islands not actually in sight, below his horizon. But in any event, whatever its value, I submit that it entirely inhibits us from assuming that he necessarily steered S.W. to the second island.

Let me illustrate. Suppose that a friend told you that he was going next day to the Motor Show, and that he intended to buy a car of a certain make. If you simply heard later that he now owned a car, you would naturally conclude, on that evidence, that it was of the make he had mentioned. But supposing that he wrote to you and said that when he got to Olympia he saw so many cars that he couldn't make up his mind at first, but finally selected a car which suited him more than any other, you would then be left in complete uncertainty as to what particular make of car it was. I apologize for labouring the point, but it is of some importance, and does not seem to have been fully appreciated in the past.

Summarizing all the evidence contained in the journal as to the size, bearings, distances, etc., of the five islands, it amounts roughly to the following:

The second island ("Santa Maria de la Concepcion") lay about 18 miles from the first island ("San Salvador" or "Guanahani")—bearing not stated. The side towards Guanahani ran N. and S. 15 miles, the other E. and W. 30 miles. It was probably in sight from a point somewhere near Guanahani, but not from that island itself.

The third island ("Fernandina") was in sight from the second, and about 24 miles west of it. It extended about 75 miles or more in a direction roughly N. 25° W. to S. 35° E. On the east side was an inviting-looking harbour which was found to be shallow. This had a narrow entrance with a rocky islet on the east side of its centre.

The fourth island ("Isabela") was not in sight from the third. Off its northern shore was a rocky islet, bearing east from the third island; distance not stated, but about four hours' run with a fair wind. From this islet the coast ran S.S.W.* to a prominent cape. The native name of the island was "Saometo" or "Samaot." It was even more beautifully wooded than the other islands, and somewhat higher, but by no means mountainous. It was suspected to consist of two closely contiguous islands, and had large lagoons.

The group of islets ("Islas de Arena") formed a chain extending in a N. and S. direction. On their south side was shallow water for some 15 miles. They were situated roughly 70 miles W. of the west side of the fourth island.

* This bearing is partly inferred. At another place in the journal it is given as W. 35 miles, which would make the cape in sight from the third island.

The fifth island ("Juana") was sighted after running about 70 miles S.S.W. from an anchorage to the southward of the group of islets.

It is possible, with these materials, to put together a very rough sketch-chart which should give some idea of what Columbus' own map, if he ever drew one, would have resembled. In so doing, strictly speaking, where the bearing of one island from another is given with no indication of the particular portion of the island to which the bearing refers, one should put the centre of the island on the bearing. But as, in the present case, both the second and fourth islands are stated to lie about the same distance eastward of the third (a long island running about N.N.W. and S.S.E.) and not to have been in sight from each other, it seems a fair assumption that the second lay somewhere off the N.N.W. end of the third and the fourth somewhere off the S.S.E. end.

It should be noted that this sketch-chart has been put together, almost entirely, by means of the relative bearings and distances of the various islands one from another, as given in the journal, and that, except where it was absolutely necessary, no use has been made of the courses and distances logged by the ships of Columbus. These latter are vitiated by all sorts of errors, such as over- or under-estimation of speed, errors of steering, leeway, current, etc., uncertain both in amount and in direction.

It is not, of course, claimed that so rough a chart can give more than an indication of the relative configuration of the islands visited by Columbus, but it will, I think, be found amply sufficient to assist in testing the comparative merits of the six complete tracks from the landfall to Cuba, which have been put forward by different authorities; and such a test is, I suggest, the most searching and the most efficient to which any theory of the landfall can be subjected.

Taking these tracks in chronological order, the first is that of Navarrete, who selected Grand Turk as the landfall, and who also assumed, on no authority that I have been able to discover, that Columbus always sailed towards the westward in his courses from the landfall to Cuba.

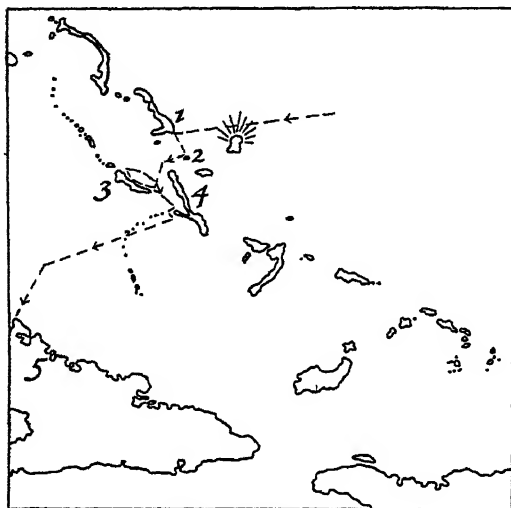


Navarrete 1824

Navarrete makes the Caicos group the second island, Little Inagua the third, Great Inagua the fourth, and Cuba the fifth (all the tracks

agree upon this last point). The courses and distances which Columbus must have traversed to follow such a route are entirely at variance with anything to be found in the journal, as also are the dimensions of the various islands; for example, the selected third island, Little Inagua, is only $7\frac{1}{2}$ miles long, instead of Columbus' 75 or so. The "Islas de Arena" are not identified but simply omitted.* As Murdock severely but justly remarks, "... It is hardly possible to imagine that this track is derived from the log at all."

Mackenzie starts from Cat Island, which he assumed to be the landfall; and it should here be noted that there is one argument in favour of



Mackenzie 1828

this theory which applies to it exclusively.† That is, that it is the only one which attempts to explain what, following Dr. Watson, the celebrated and Boeotian companion of Sherlock Holmes, might well be called "the singular incident of the light in the night-time"—an incident which has always been one of the standing puzzles in connection with this subject. About 10 p.m. on the night of October 11—i.e. about four hours before making the landfall and an hour

before moonrise—Columbus and others with him on the poop of the *Santa Maria* saw, or thought they saw, a light some distance away in the darkness. It is described as looking like the flame of a small candle, alternately raised and lowered. It seems to have gone out of sight again not long after.

Judging by the speed of the ships, as given in the journal for this night, the light must have been some 35 miles or so eastward of the landfall, and well to windward of it. Markham considers that it must have been in a native canoe, but does not suggest any reason why such a craft should have made so laborious and purposeless an excursion out into the Atlantic, away from the Bahamas, and practically dead to windward. Nor does it seem likely that a native canoe would have had

* Murdock states that Navarrete omitted the fourth island, as well as the "Islas de Arena," but this is incorrect. See above.

† So far as the "Big Five" are concerned. The selection of Conception Cay (Conception I.) as the landfall would also allow of our supposing that the light was on Watling I.

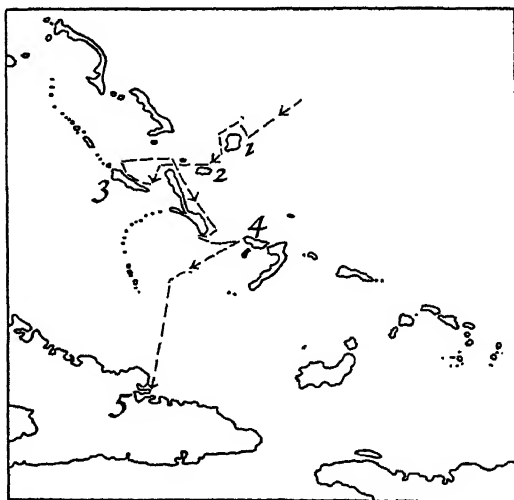
much use for a light, or have carried the appliances for making and exhibiting it.

Murdock cuts the Gordian knot by suggesting that the light was non-existent—a figment of excited imaginations. This theory of collective hallucination is certainly possible, but it seems rather a drastic way of treating inconvenient evidence. Mackenzie, on the other hand, supposes that the light was on Watling Island, and that Columbus, owing to the darkness, missed that island, although seeing the light, and passed on to make his landfall at Cat Island. This theory, taken by itself, seems reasonable, as the run between light and landfall would then fit in quite well. But it is, on any supposition, very surprising that if Columbus, as he seems to have done, looked on the light as a sure indication of the long-expected land, he should have calmly proceeded under all plain sail and let it go out of sight astern, instead of clewing up and waiting for daylight, or even for moonrise.

From Cat Island Mackenzie sends Columbus to Conception Cay, which he selects as the second island, making Great Exuma the third, and Long Island the fourth; after which he despatches him south-westward to Cuba, straight across the Great Bahama Bank. This portion of the route and also that between Exuma and Long Island is, and probably always has been, practically unnavigable.

In addition to this fatal defect in Mackenzie's track, his second island is far too small, and his third island is not in sight from it. Moreover, he makes Columbus go from Conception Cay to Exuma without apparently noticing Long Island, although we are told in the journal that he resolved to pass no island without taking possession of it.

Becher, having fixed on Watling Island as the landfall, makes Rum Cay the second island. As explained, the latter's bearing from the landfall is uncertain, while as regard distance, Rum Cay fills the bill more or less satisfactorily. Columbus, however, describes the second island as about 5 *leagues* N. and S. by 10 E. and W., while Rum Cay extends only



Becher 1856

about those numbers of *miles* in such directions. Becher neglected this point; but it does not seem to be a fatal objection. It was later shown by Murdock, and I think conclusively, that Rum Cay is a more generally

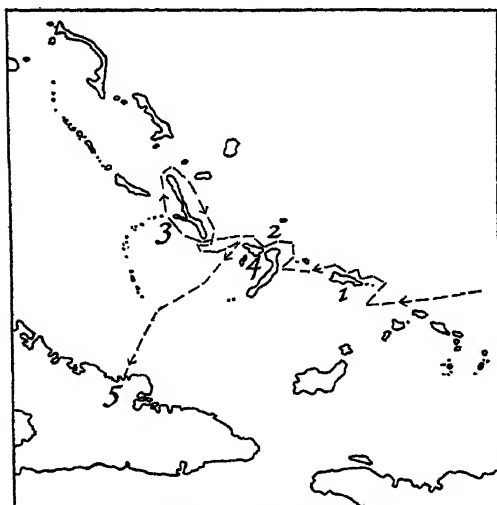
satisfactory "second island" than any other yet proposed, and it may be noted that its dimensions agree in relative proportion, although not in actual amount, with those given in the journal. It is possible that Las Casas, or the copyist, simply wrote "leagues" for "miles,"* which would explain the whole difficulty; but one hesitates to make such assumptions, since it is fatally easy, in this manner, to twist facts to suit theories.

But Becher, having gone so far, proceeds to go definitely and demonstrably wrong in his further discussion of the track. Mis-translating an expression in the journal, "... cargué las velas ..." ("clewed up the sails") as "... I made sail ..." he sends Columbus, in flat defiance of the journal, past the second island, Rum Cay, without stopping, and thence to the third island, which, like Mackenzie, he identifies as Great Exuma. He then, to the confusion of common sense and, one would think, in utter forgetfulness of his own very considerable nautical experience, assumes that during the night of October 16-17 Columbus, in a gale and off an unknown coast, ran 100 miles in ten hours along the east coast of Long Island without noticing that it was not part of Exuma, and so arrived on the following day at Crooked Island, which Becher selects as the fourth island. Putting aside the fact that no sane man would navigate in so utterly reckless a manner, it need merely be pointed out that the gale in question only existed in Becher's imagination, the journal for that night recording "... the wind was light and did not allow me to

reach the land to anchor" As Fox rather caustically suggests, Becher appears to have confused Columbus with Vanderdecken.

From Crooked Island Becher makes Columbus anchor south of the Ragged Islands, which he identifies with the "Islas de Arena," and then lets him go on his way, without further perilous adventures, to Cuba.

A curious error, arising directly out of Becher's resolve not to let Columbus stop at the second island,



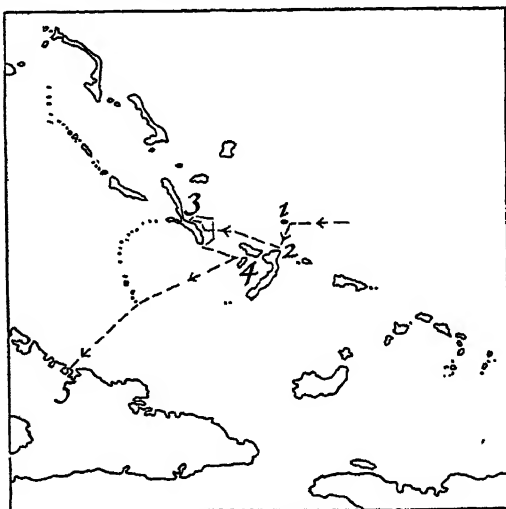
Varnhagen 1864

still appears on the Admiralty charts. The name of that island, "Santa Maria de la Concepcion," is divided, one half appearing as C. Santa Maria (Long Island), and the other half as Conception Island!

* Markham, having mooted this assumption in his 'Columbus,' states it as a simple fact in his translation of the 'Journal.'

Varnhagen, assuming Mariguana as the landfall, makes the second island Acklin Island. Regarding Acklin and Crooked Islands as one (they are closely contiguous), this would agree fairly well with the dimensions given in the journal, although not at all with the distance between the first and second islands. He fixes on Long Island for the third island, and makes Columbus circumnavigate it—after which he brings him back to Crooked Island, which he must have passed on his way to Long Island, and makes him regard it as an entirely new discovery—the fourth island! Like Becher, he identifies the “*Islas de Arena*” with the Ragged Island chain.

Fox, although selecting Samana as his Guanahani in place of Mariguana, is otherwise in substantial agreement with Varnhagen. Like him, he goes to the Crooked Island group for the second island, although he selects Crooked Island itself, and not Acklin. He too makes Long Island the third island, and brings Columbus back, afterwards, to the Crooked Island group for the fourth island, this time selecting Fortune Island, close S.W. of Crooked Island. He agrees with Varnhagen (and with Becher) as to the identity of the Ragged Island group with the “*Islas de Arena*.”

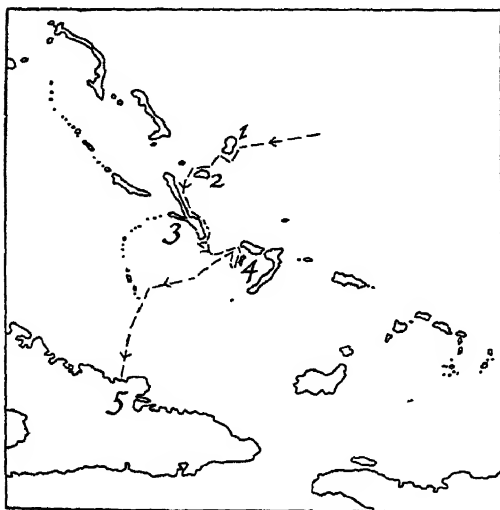


Fox 1882

From the text of the journal itself, and on such grounds alone, the plan, followed by Varnhagen and Fox, of making Columbus sail halfway round the Crooked Island group, proceed to Long Island, and return again to the Crooked Island group under the impression that it was an entirely new and different “fourth island,” out of sight of the “second island—*i.e.*, practically, of itself—seems entirely untenable, and remarkable only as an excellent example of the extent to which very able and honest men can, under the influence of theories, shut their eyes to facts. It seems scarcely necessary to “flog the dead horse” any further, but it may be pointed out that Long Island, for instance, is not visible from any part of the Crooked Island group, whereas Columbus most distinctly stated that the third island was in sight from the second.

The track worked out by Murdock in 1883 differs greatly from its predecessors—not only in its configuration, but in its superior plausibility, and also in the method by which it was obtained. Instead of starting

with some island assumed as the landfall and then constructing a track from this to Cuba, Murdock reversed this plan, and worked backwards from Cuba until he reached the landfall.*



Murdock 1884

bour in which he first anchored, are not so easy to locate. There are at least four candidates for the latter—Port Nipe, Port Gibura, Port Padre, and the Boca de Caravela. The only real clue is a statement in the journal that the harbour had a wide entrance with 12 fathoms of water. None of the four exactly corresponds with this. Murdock, with considerable probability, selects Port Gibura.

It might be thought, then, that whether you work out the track forwards or backwards you have to assume a starting-point. But, as Murdock showed, this can be avoided in working from Cuba to the landfall. The first point to identify from Cuba is the anchorage at the "Islas de Arena," which, from the journal, is found to have been about 75 miles N.E. from the harbour in Cuba. If, therefore, one takes the outline of the N.E. coast of Cuba and transfers it bodily 75 miles N.E., this line should pass through or near the anchorage south of the "Islas de Arena," and a short examination shows that these can only have been the Ragged Islands.

Having determined this point, it is similarly possible to work backwards to the position, off the fourth island, from which Columbus took his departure for the "Islas de Arena." This is given in the journal as being S.E. 21 miles from the south point of the third island, and about W.S.W. from the rocky islet at the north end of the fourth island, while it was about 65 miles E. $\frac{1}{2}$ N. from the "Islas de Arena" (which have

* This is undoubtedly the more scientific method. It is, however, curious to note that Caleb Cushing, in an article in the *North American Review*, remarks that after applying it "we... shall be convinced that Guanahani is no other than Turk's Island" !

just been identified as the Ragged Islands). These data point with practical certainty to Long Island as the third island, and Crooked Island as the fourth,* the rocky islet being Bird Rock off Crooked Island, which agrees exactly, both in position and appearance, with the account given in the journal. The harbour on the east side of the third island was probably Clarence Harbour, Long Island.

So far then, working backwards from Cuba, the "Islas de Arena" and the fourth and third islands have been identified with very fair certainty. It remains to identify the second island, and thence, if possible, the landfall. And it is here that the real difficulties begin.

As previously suggested, since the third and the second islands are both stated to be situated about the same distance—25 miles or so—eastward of the third, and out of sight of each other, it is a reasonable assumption that the third lay off its S.E. extremity, and the second off its N.W. If this is accepted, the second island almost selects itself—it must be Rum Cay; there is no other available. On the other hand, there are two objections to this identification. One is, that the distance to Long Island is smaller than Columbus states, being only 15 miles instead of 21 or so; and the other is the discrepancy in size, although not in shape, already mentioned. The distance, however, was probably overestimated by Columbus; in fact, it must have been, for if it had really been 21 miles the third island could not have been seen from the second unless it were far higher than any land now known to exist in the Bahamas. Murdock considers that the fact that Rum Cay is the only possible "second island" in sight from Long Island must be set off against the discrepancy in distance; but I suggest that he might, with more reason, have argued that this discrepancy was in fact unimportant, and that the only difficulty was the discrepancy in size. On the whole I think that, reviewing and balancing all the data, there cannot be much doubt that Rum Cay has a pre-eminent claim to be regarded as the second island, although it must be admitted that the identification is not so convincing as in the cases of the islands sighted subsequently.

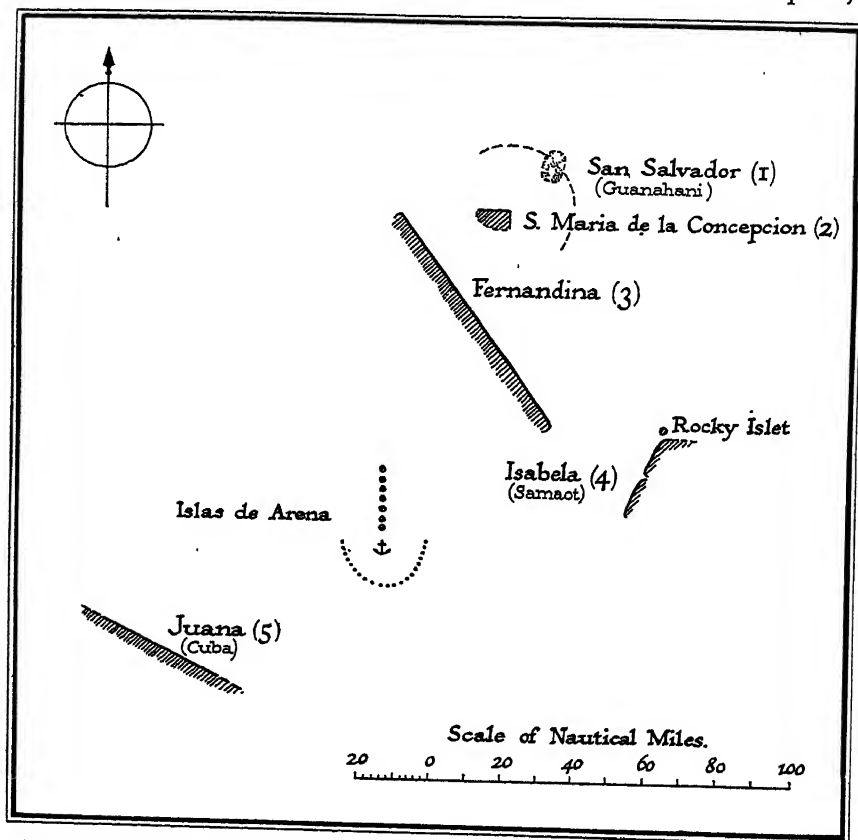
So far I have, in essentials, simply followed and endorsed Murdock's argument. But, for the reasons I have already given, I cannot altogether assent to his final step. Having reached Rum Cay, he says in effect this: "The second island lay about 21 miles S.W. from the landfall. Rum Cay is the second island, and it lies about 19 miles S.W. $\frac{1}{4}$ S. from Watling Island. Therefore Watling Island must be the landfall."

The correct conclusion, I suggest, should be this: "Rum Cay is, in all probability, the second island. That island, we are told, lay about 18 miles from the landfall, bearing not stated. The landfall must be

* It may be noted that the native name of Crooked Island is "Samoete": compare the name "Samaot" recorded in the journal as being given by the natives to the fourth island.

an island agreeing with Columbus' description, and lying on or near a circle of 18 miles' radius drawn from Rum Cay."

Actually, it makes little difference. If we draw such a circle, there are but two islands on or near it. Watling Island is one of them, Conception Cay the other. Watling Island agrees in every respect with the account in the journal—Conception Cay does not.* Cat Island, whose southern extremity does accord fairly well with the description,

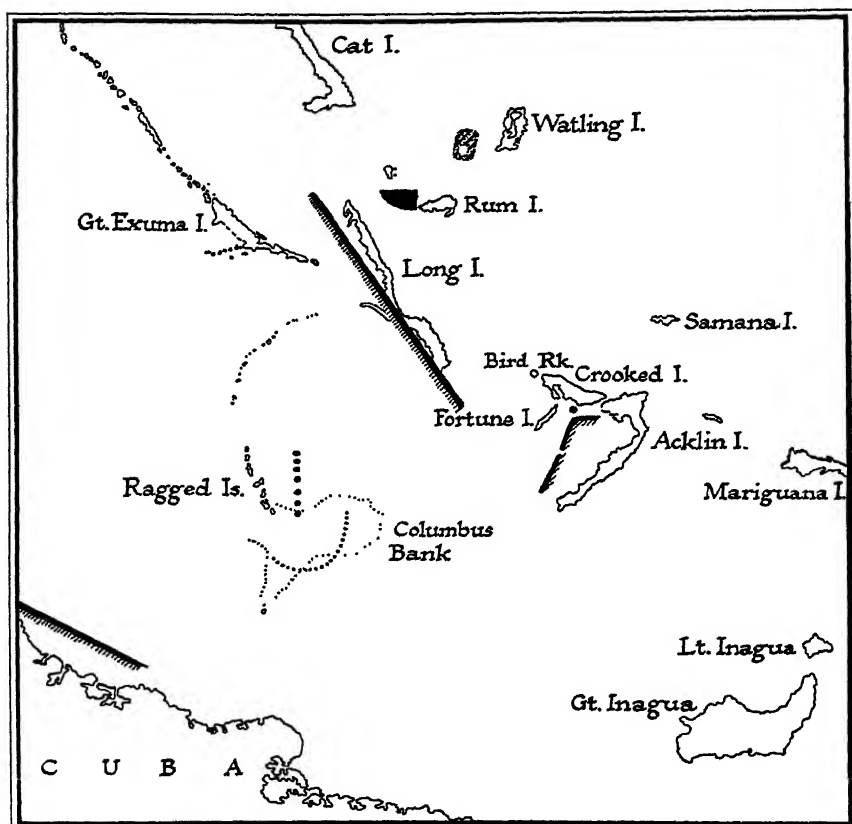


Relative positions of the five islands sighted by Columbus laid down from the data on p. 414. Gould 1927

and which alone of the "Big Five" claims to explain the mysterious light, is a long way outside the circle—its minimum distance from Rum Cay is 34 miles—and there is no other possible claimant; at least, no other now rising above the surface of the Atlantic.

* It is very small— $2\frac{1}{2}$ by $1\frac{1}{2}$ miles—grows only stunted vegetation, and has a conspicuous detached islet on its east side which Columbus would certainly have mentioned. On the other hand, it possesses a lagoon and a fringing reef, part of its coast runs N.N.E., and, equally with Cat. I., its selection as the landfall would explain the mysterious light.

I ought, in conclusion, to indicate a question, in connection with the identification of Guanahani, to which it does not seem likely that any satisfactory answer will ever be given. I have already referred to two difficult points—the light, and the archipelago said to have been seen by Columbus immediately on sailing from Guanahani; and I might mention that I once thought I had evolved a theory which would cover both of them. I should explain that I had then been studying the question



The relative positions superposed upon a modern chart of the Bahamas

for fully six hours, and was, in consequence, quite convinced that I knew all about it. I thought that by selecting the S.W. point of Cat Island as my landfall (Mackenzie took the S.E. point) and assuming that Columbus, on weighing, stood westward for some distance across Exuma Sound, he would then have sighted the string of cays stretching N.W. from Great Exuma, while the light, as Mackenzie suggested, would have been on Watling Island. Unfortunately, further consideration knocked the bottom out of this theory altogether. For it to hold good Great Exuma must have been the second island, with whose description it does not

agree to any noticeable extent, while all around the corresponding position in which the third island ought to be there is, unfortunately, a painfully aching void.

The difficulty to which I am now referring, however, offers no loop-hole for such off-hand speculations. It arises from an entry in Columbus' journal about a month later (20 November 1492). He there states that, being in a position E.S.E. of Babeque, he was at the same time 12 leagues from Isabela (the fourth island), adding the exasperating note that Isabela is 8 leagues from Guanahani, or San Salvador. It seems quite impossible to reconcile the courses, distances, and bearings given in the journal between October 12 and 20 with the statement that the landfall and the fourth island, or any part of them, are only some 24 miles apart. The minimum distance between Watling Island and Crooked Island is about 67 miles. We must, I think, take refuge in the last resort of the baffled investigator, and declare that the passage in question is corrupt.

It may be noted that while Columbus himself never revisited the Bahamas, and while they were not much explored by his immediate successors, there is a passage in the account of Ponce de Leon's first voyage to Florida in 1512 which seems, at first sight, likely to throw a good deal of light on the identity of Guanahani. Unfortunately, it flatters only to deceive. According to Herrera, de Leon on his sixth day out from Porto Rico arrived at Caicos, in the Bahamas, and on the eighth at an island named Yaguna, in lat. 24° N. From this he went to another named Manuega, in lat. $24^{\circ} 30'$, and on the eleventh day arrived at Guanahani, in lat. $25^{\circ} 40'$ N., which, it is added, was the same island as that first discovered by Columbus, and by him named San Salvador.

Whatever the actual error of these latitudes might be (and it is probably considerable) we could, assuming that it was fairly constant for all, use them to identify Guanahani if we were certain of Yaguna and Manuega; or, conversely, we could, if we were certain of Guanahani, identify the other two. But we are not certain of any of them, and it is fatally easy, in hunting round for Yaguna and Manuega, to fit these names on to some promiscuous pair of islands which agrees with that theory of the identity of Guanahani which one happens to hold. Both Humboldt and Fox certainly appear to have done so. I am afraid that this itinerary of de Leon's is not of much assistance.

But I suggest that while we may never, in the absence of Columbus' full journal and/or map, have absolutely irrefutable evidence as to the identity of Guanahani, we have at least enough to support a strong and reasonable conviction. Like many other celebrated historical mysteries, research has narrowed the issue down to a comparatively small compass. Just as it is fairly certain that the Man in the Iron Mask was either Mattioli or Eustache Dauger; just as it is long odds on Sir Philip Francis for the Junius Stakes against any other nominee; so, I suggest, is it reasonable to take the view that nearly two centuries of discussion and

research have by no means been barren of result ; that they have ventilated the question pretty thoroughly ; and that they have shown that, although the data that we possess embody so many and to some extent so conflicting requirements that it is highly improbable and probably impossible that any one island will ever be found to satisfy them entirely, there is one which stands head and shoulders above the others in the number which it satisfies and the fewness of those which its selection compels us to reject. And that island is Watling I., or, if we must give it its new legal title, (San Salvador or) Watlings Island. Whether we go by the evidence of the charts of de la Cosa and Herrera, by that of the description of the landfall given by Columbus himself or by that of the track which he followed from the landfall to Cuba, and on whatever system we "weight" the results of these examinations, we are, I submit, independently led in each case to the same conclusion, while the cumulative effect of this triple agreement is almost irresistible. Eclipse is first, and the rest nowhere. In rejecting, if we decide to reject, the claims of Cat Island (which, next to Conception I., I should class as *proxime accessit*), Mariguana, Samana, and Grand Turk, we imply no censure upon their advocates—rather, I suggest, do we actually honour their labours, all of which have, indirectly, contributed to at least a provisional solution of this famous problem.

It is invidious to make a selection, but it is difficult in such a matter to avoid having a preference, and I should like to take this opportunity of putting it on record, as my personal opinion, that it is to Lieut. (now Rear-Admiral) J. B. Murdock, U.S.N., more than to any other man, that the world owes the first clear and impartial statement, unshaken in essentials by later criticism, of the reasons which go to show that in all probability Watling Island is the true Guanahani—the San Salvador of Columbus, and the spot where, on that eventful morning in 1492, our half of the world began, for the first time, to know *where* the other half lives. *Palmam qui meruit ferat.*

Before the paper the CHAIRMAN (Sir PERCY COX) said : The President is unavoidably prevented from being here this afternoon and has asked me to take the Chair for him. I have to introduce Lieut.-Commander Gould, of the Hydrographic Department of the Admiralty, who is to read us a paper on the Landfall of Columbus. The Landfall of Columbus has been a matter of perplexity to geographers for the last four hundred years. Various permutations of the voyage have been worked out and adopted by students, but the origin of Commander Gould's paper was a short article in our *Journal* for October 1926 ("The Landfall of Columbus," vol. 68, p. 338). To a correspondent who put forward the claim of Grand Turk the Society had replied that there is no one island in the Bahamas group that meets all the requirements of the narrative, and it is not likely that the question can ever be definitely solved. The article went on to say that "the Admiralty are however more confident," and quoted the West Indies Pilot on San Salvador or Watling Island, "the established landfall of Columbus." The Hydrographer at once asked Commander Gould

to examine the problem, and this afternoon's paper is the very interesting result of his work.

Commander Gould then read the paper printed above, and a discussion followed.

Admiral H. P. DOUGLAS (Hydrographer of the Navy): I think you will agree with me that we have listened to a most interesting lecture, and I am particularly pleased that it affords evidence of the care taken by the Admiralty as regards the names on their charts. The Admiralty often hear, from people in various parts of the world, that they do not give the correct names on their charts, but I think that in this case you will agree that undoubtedly, from all the evidence available, Watling Island is the one which is best fitted to bear Columbus' name "San Salvador." In case any one should think that the subject is, at this date, somewhat academical, I may say that the lecture has not been compiled in Government time! I was interested in the slide showing the superimposed map. It is, from the Hydrographic Department's point of view, almost complete evidence. But there is just one other point which it might be of value to discuss, and that is, looking at it (as one can) from a sailor's point of view, the circumnavigation, or partial circumnavigation, of the landfall. Running before a north-easterly wind, Columbus must have passed either north or south of it to get a lee; it is improbable that he would, or could, have landed on the weather side. As between Cat Island and Watling Island, he could hardly have landed at the south-east point of either; the south-east point of Cat Island is not a sheltered anchorage any more than the south-east point of Watling Island. Now, if he went round the north point of Watling Island he could have found anchorage there at his "two lombard shots" off the shore; but if he went round the north side of Cat Island he would not have got through to an anchorage—probably he would not have tried to, because he must then have sighted the mass of breaking reefs which fill the channel between it and the island of Eleuthera. That being the case, if his landfall was Cat Island he must have gone round the south side and have anchored more or less under the lee of the south-west extremity of that island. In such a position he would not have seen a lagoon, while if he anchored either on the north-west or south-west side of Watling Island he would have. That, to my mind, is a strong argument in favour of Watling Island *versus* Cat Island.

It is unfortunate that the Bahaman Legislature has now altered the island's name to "Watlings," and we are rather puzzled about this at the Admiralty, because we do not understand why it has been done. Every one knows that Watling was a celebrated buccaneer, and if the island is to be known as Watling's island—the island of Watling—it ought to have an apostrophe. We shall take that up, and, if necessary, we must amend the charts. On the other hand, it is a pity that, at this distance of time, it is difficult to tackle the mistake made by Becher in naming the north point of Long Island "Cape Santa Maria" and giving Booby Cay the name of "Conception Island." The whole of Columbus' name "Santa Maria de la Concepcion" should, apparently, have been given to the island of Rum Cay. I dare say, however, that if this error is discussed with the Bahaman Government we may be able to improve matters a little upon this point as well.

I think you will agree with me that it is gratifying to hear that a United States naval officer has already given such a clear and valuable summary of all which we have heard this afternoon, and that the conclusions to which we have come are fully supported by Admiral Murdock.

The CHAIRMAN: Would the Librarian to the Admiralty like to say anything?

Mr. W. G. PERRIN (Admiralty Librarian): I am afraid it would be only waste of time for me to say anything, because this question of evidence is one for expert navigators. As regards the logic with which Commander Gould has presented his conclusions I can find no fault with it.

Mr. HEAWOOD: I can only express my admiration for the way in which Commander Gould has dealt with this difficult subject. I cannot claim to have studied it at all closely, and in asking one or two questions, I do so simply with a view to eliciting information, and without any wish to criticize. Does Commander Gould know of a paper by J. W. Redway, published in 1894, in which the opinion of Fox in favour of Samana as the landfall finds support; and if so, does he think it unworthy of consideration? Mr. Redway cites other maps than those of La Cosa and Herrera, and I confess I was a little surprised that Commander Gould should have made a jump of a century from one to the other, disregarding entirely all maps of the intervening period, some of them by men of great nautical experience. Some of these maps apply the names Guanahani and Samana to one and the same island, and even when they are assigned to different islands this surely is no certain disproof of identity, considering the way in which features are constantly found duplicated in old maps. A second question is, cannot a study of the winds and currents as now known be some help in checking or correcting the estimates of distances sailed, necessarily made by the navigators in ignorance of their existence? It would be interesting to hear Commander Gould's view on this point.

Note added after the Discussion by Mr. Heawood.

The above remarks were made on the spur of the moment, and represent no considered opinion on the subject. Still, I cannot help doubting whether the two maps cited by Commander Gould stand on such a totally different footing from the rest as to be alone worthy of consideration. The official Spanish chart-makers of the early decades of the sixteenth century must have had much original information to work upon—at least as good as was at the disposal of an historian writing many years later, with no special qualifications either as a seaman or cartographer. If, as is possible, the early official mapping of the Bahamas is too vague to be of any help, ought we not to discard the evidence of maps altogether, for even La Cosa's gives but a distorted picture in many parts? Again, granted that our present knowledge of winds and currents gives no help, can we trust at all to estimates of distance made by those who entirely lacked such knowledge? This does not, however, lessen my appreciation of the general soundness of Commander Gould's methods and the lucid way in which he has re-stated the problem. He has certainly shown that the odds are greatly in favour of Watling Island as the landfall.

Lord EDWARD GLEICHEN: Has volcanic action anything to do with the subject? In other parts of the world where volcanic action is frequent islands disappear and rise again in a strange manner. Is it conceivable that volcanic action may have had anything to do with the contradiction in regard to these islands?

The CHAIRMAN: There are two points I would like to ask Commander Gould to include in his reply. He mentioned that the Bahama Bank was unnavigable and might be ruled out of consideration. Is it known what the draught of the vessels at the time of Columbus was? Is it quite clear that they could not have sailed over the Bank if it had been in their way? Secondly, it

seems surprising to me that it has never been possible to get any corroboration of the native names. Commander Gould has explained that most of the natives of the island were exterminated at the time, but all the other islands must have had a name for their sister islands. It is surprising that it has never been possible to get any more evidence on that point.

Lieut.-Commander GOULD: The point raised by Admiral Douglas is one more which tells strongly in favour of Watling Island as against Cat Island. To my mind, the identification of Watling Island with the landfall is fairly certain, so far as the known evidence goes. If any further important evidence should come to light which would necessitate a reversal of this view it would probably take the form of some old map or document in the Spanish archives. It is, of course, still possible—but most improbable—that Columbus' own journal and/or map may one day be found.

With regard to the points raised by Mr. Heawood, I have not yet seen Mr. Redway's paper, although I knew of its existence. I confess that I did not attach very much importance to consulting it, bearing in mind the very poor case which so able an advocate as Fox could make out for Samana, and the pronounced physical differences between that island and Columbus' description of the landfall.

The question as to the old maps is very difficult to answer. Undoubtedly there are many post-Columbian maps of America which might be consulted—Kretschmer, for example, in his 'Entdeckung Amerika's' Atlas reproduces nearly sixty. You might spend weeks analyzing all such maps, but I do not think that you would come to any very definite conclusion. I took those which seemed to me to be most important—de la Cosa's and Herrera's—because the former was drawn by one of Columbus' companions who was present at the landfall, and the latter is, so to speak, the official standard map. I do not think that any others you can adduce are equally important, and many of the intermediate ones have no pretensions to accuracy. They are often more pictorial than geographical, being covered with castles, saints, flags, etc.; and, generally speaking, I do not regard them as being of great value one way or the other.

With regard to Samana being shown as Guanahani on some such maps, it does not surprise me at all. In fact, it would not surprise me to find Cuba itself called Guanahani on a map of the kind, although I have never seen this. The point about Guanahani, Samana, and Mariguana appearing on the maps of de la Cosa and Herrera as separate and distinct is that if duplication of islands occurs on an old map, as suggested by Mr. Heawood, it generally happens in respect of islands in the same latitude. But in the present case all three are shown in both maps as separated by appreciable differences of latitude.

The matter of winds and currents has been gone into thoroughly by Fox and Murdock. In my opinion, any conclusion you reach is not so much conditioned by the ascertainable facts as by the preliminary assumptions you make, such as the ship's initial position, the time she was on some particular course, the exact force and direction of the wind, and so on. I am afraid you get very little further, however deeply you go into it.

With regard to volcanic action, as I explained in the paper it is doubtful whether any volcanic action which could have changed the Bahamas so completely during the intervening centuries as to mask the landfall has ever occurred. We know that where you have had whole islands, such as Graham Island, coming up and sinking again you find evidence, in your soundings, of volcanic dust, etc., and you generally find igneous rocks or lava deposits in

the neighbouring islands. So far as I know, there is no evidence of this kind in the Bahamas.

In reply to Sir Percy Cox's question as to whether Columbus could have crossed the Bahama Bank, the draught of his ships is not definitely known. I think that even the largest, the *Santa Maria*, was of what we should now call less than 100 tons gross, and probably did not draw more than 9 to 10 feet of water. It is quite conceivable that he might have got across, but on the other hand it would have meant taking enormous risks. Certainly he would not have done it when he could easily see a much safer way round; and, beyond all doubt, he would not have attempted it at night. I think that one can safely rule that out. He might, by great skill, have taken his vessels over, but I do not think that any discoverer in unknown waters would ever cross such a bank if he could avoid it.

With regard to the question of native names, it is, I believe, a fact that comparatively few of the Bahamas have definite native names, so that it is not at all surprising that one cannot trace the name "Guanahani." That, however, is a question for ethnologists and philologists rather than for geographers.

Note added after the Discussion by Lieut.-Commander Gould.

With reference to Mr. Heawood's additional remarks, the points raised by him are of great importance, and I am very glad that he drew attention to them, since, on re-reading my paper, it certainly gives the impression that they had been rather cursorily examined. This, however, is not actually the case. When collecting material, I re-examined the analyses of winds and currents given by Fox and Murdock, and only decided to omit a discussion of the results from the paper when I became convinced, for the reasons already given, that they were of little practical value. It was for this reason that, in attempting to reconstruct Columbus' chart, I relied as much as possible upon the recorded inter-insular bearings and distances (which, however much they may be affected by personal equation, probably have a more or less constant error, and are in correct proportion) and as little as possible upon the courses and distances logged as run by the ships.

Similarly, I consulted a great many of the post-Columbian maps of America, although of course I cannot claim to have covered this field exhaustively. I saw, however, enough of them to make me conclude that the majority could scarcely be regarded as contributing any evidence of material importance to a solution of the problem of the landfall; and from a rather chaotic mass of material, much of it obviously at fourth or fifth hand, I selected for mention the two maps which, as I thought and still think, were decidedly the most authoritative and reliable guides to follow. Such a selection, however, is purely a matter of personal opinion, and it was for that reason that I did not lay more stress upon the evidence they afforded.

The CHAIRMAN: We have had a most interesting paper. I think we realize what a great amount of study and industry must have been devoted to the task of evolving order out of the chaotic state of the evidence. We have had a clear exposition, and I think we go away with some idea of the reasons which have prompted our own Admiralty and the American Navy to accept Watling Island. It is a matter of congratulation that our experts and those of the United States Navy are at one in the matter, and we may regard it as practically laid to rest as far as any question of the kind can be. It only remains for me to ask you to thank Commander Gould for his paper.

NEW POLITICAL BOUNDARIES IN THE CAUCASUS

W. E. D. Allen

Folding map follows p. 496.

Events in the Caucasus, 1916-1924.

THE former Russian Vice-royalty of the Caucasus comprised all the territory between the line of the Manich Depression on the north—bordering the Government of Astrakhan and the territory of the Don Cossacks—and the Turkish and Persian frontiers on the south and south-east. With the collapse of the Imperial *régime* in the spring of 1917, and the seizure of power by the Bolsheviks in the autumn of the same year, a process developed throughout the Russian Empire of disintegration into component national units. That part of the Vice-royalty lying north of the Caucasus mountains, comprising the Government of Stavropol and the Provinces of the Kuban and Terek Cossacks, remained politically a part of Russia, and was during 1918 and 1919 one of the principal theatres of military operations during the Russian Civil War. In the eastern mountains, including the Chechen and Ingush districts and Daghestan, acutely anarchic conditions prevailed. The tribesmen became alternately the dupes of Turkish and Tatar political adventurers, and the victims of the military excursions of the contending "Red" and "White" factions. In the first month of 1918 a "Republic of the Mountaineers"—alternately "Gorskaya" or "Dagestanskaya Respublika"—was formed, with a capital, first at Vladikavkaz, later at Nazran, and finally at Temir-Khan-Shura (now Buinaksk). In March 1919 Denikin occupied Temir-Khan-Shura. In the autumn, however, the tribes rose, and Denikin was only suppressing them with difficulty at the moment when his northern front was broken by the Bolsheviks. It was not until a year later that the Bolsheviks finally re-established Russian authority in the mountains in a six months' campaign lasting until May 1921, which involved much sharp fighting, and of which a recent account, published in Moscow,* recalls Baryatinski's operations against Shamil.

In Transcaucasia, the three republics formed during 1918 on a national basis failed to maintain both their independence of Russia and their democratic systems of government. The failure was due as much to economic as to political reasons. In April 1920 the "Musavetist" or nationalist Government of Azerbaijan, who had for a long time been contending with a severe crisis in the petroleum industry—a crisis insoluble without access to the Russian market—withdrawn from

* 'Krasnaya armiya v gorakh' ('The Red Army in the Mountains: Operations in Daghestan,' by A. Todorski). 187 pages, with maps, plans, and tables. "Voenni Vestnik," Moscow, 1924.

Baku, and the "Hummet" or local Bolshevik party received the Russian troops, who arrived on April 27 to occupy "the oil city." By the autumn of 1920 the position of the Armenian Republic had become hopeless, unless substantial support, both financial, diplomatic, and military, could be obtained from the Allies. This was not forthcoming, and in December, when the troops of Kiazim Pasha Karabekr had already occupied Kars and Alexandropol (now Leninakan), the members of the Dashnakist (nationalist) Government retired to Tabriz, and the local Bolsheviks set up a Soviet Government, and welcomed the arrival at Erivan of Russian troops to hold the Turkish advance.

To all political observers it was now obvious that the situation of the Georgian Republic was hopeless. The position of the Republic was weak, both financially and economically, and psychologically the people were either divided or indifferent. In March 1921 the Soviet troops, without a declaration of war, invaded the territory of the Republic at four points—by the Kura Valley, the Daryal Defile (Georgian Military Road), the Mamison Pass (Ossetian Military Road), and the Gagri Pass (Black Sea coast-road). Within a month the whole of Georgia was in Bolshevik occupation, and Russian authority had been restored over the whole of the former Vice-Royalty, with the exception of the border districts seized by the Turks from the Armenians in December 1920, and from the Georgians in March 1921.

The whole of Transcaucasia was, however, still subject to sporadic outbreaks, inspired by the national or religious sentiments of the different populations. In June 1920 there were Tatar risings at Elisavetpol (now Ganja) and Shamkhor, and in the spring of 1921 two or three Dashnakist outbreaks in Armenia; in the autumn of 1922 and the spring of 1923 an expedition was engaged in the pacification of Svanet'hi, and suffered some reverses; and in the spring of 1924 a formidable Georgian revolt swept the Rion (Rhioni) valley and the eastern district of Kakhet'hi.

The Transcaucasian Socialist Federated Soviet Republic.

The growth of national self-consciousness among the minor racial groups of the old Russian Empire has been a slow and obscure process during the last fifty years. The movement, or rather the various movements, are complicated by a number of conflicting tendencies, which have had a contemporary development. Economic Socialism and political internationalism; Agrarianism and Communism; the essentially Pan-Slavonic, yet anti-Muscovite, basis of Ukrainian and of White Russian nationalism; the hesitation in Georgia and in Armenia between a "European" and a "Russian" orientation; among the Tatars between an "Osmanli" and a "Russo-Turanian" orientation, between "Pan-Turanism" and "Pan-Islamism": all these trends and attitudes have tended to ferment a political and economic confusion, which has expressed and is expressing itself in innumerable conflicts, which continue

to have their reactions over the whole of Eastern Europe and Western and Southern Asia.

The Bolsheviks have attempted to evolve a solution which will marshal and combine all the conflicting tendencies and movements of the nationalities of the former Russian Empire, in the formula of the Union of Soviet Republics.

The Union comprises officially six Soviet Republics or Federated Soviet Republics: the Russian Socialist Federated Soviet Republic, the White Russian Socialist Soviet Republic, the Ukrainian Socialist Soviet Republic, the Transcaucasian Socialist Federated Soviet Republic, the Usbek Socialist Soviet Republic, and the Turkoman Socialist Soviet Republic. Formally, therefore, the Union is no more distinctly Russian than it is Ukrainian, Usbek, or Georgian. The constitution of the Union is extremely complicated, and for its elucidation a separate paper would be necessary.* In effect it may be said that all the elaborate rights of the constituent nationalities of the Union are not permitted to interfere with the dictatorship of the Communist Party. The nationalities have, however, scope for a limited development, primarily linguistic and cultural, within the Union. The whole system is both interesting and significant. The philosophy upon which the system is based aims in theory at a World Federation of peoples, and in practice and policy, at a Federation of Asiatic peoples, the influence of which may well prove both attractive and disturbing from the Balkans and Western Asia to Korea. Within the Union itself the system is already provoking a conflict of opinion between (1) those elements who are concerned primarily with world-revolution, (2) those who wish to adopt a Pan-Slavonic basis, and (3) those representatives of minor nationalities who are anxious to develop and improve the position of the national groups. It may at

* The Constitution of the Union is set out in a Foreign Office Blue Book, 'Soviet Russia: A Description of the Various Political Units existing on Russian Territory, to which is appended the Constitution of the Union of Socialist Soviet Republics of July 6, 1923 (with two maps). Compiled from material supplied by the British Commercial Mission in Moscow' (H.M. Stationery Office, 1924). This publication has now become in some minor respects out of date. It was published before the formation of the Turkoman Socialist Soviet Republic, and before the liquidation of the Gorski Autonomous Socialist Republic (see p. 438 of this paper). In the spelling of Caucasian names the Russian forms have been very closely followed.

For the Constitution of U.S.S.R. and for present political divisions compare also the 'Soviet Union Year-Book,' 1926, 'The Statesman's Year-Book,' 1926, and Dr. Haden Guest, M.P.—'The New Russia.' In none of these publications is the present political geography of Central Asia really adequately elucidated. Much information on both the Caucasus and Central Asia may, however, be found in *Novi Vostok* ('The New East'), a periodical publication of the All-Russian Scientific Association of Eastern Studies.

But probably the best available authority for the new political divisions is the Administrative Map of S.S.S.R. (1) European Part, 1:3,000,000, January 1925; (2) ditto, 1:4,200,000, October 1925; (3) Asiatic Part, 1:10,500,000, February 1925 (all in the Society's collection), published by the Cartographical Section of the National Ministry for Internal Affairs.

any rate be anticipated that the divisions established within the Union will have a permanent value at least in the collective minds of the nationalities concerned, and any future government in Moscow which attempts to return to a definite Pan-Slavonic basis, will be confronted with the necessity of combating or placating varied and strengthened national movements over all the southern and eastern extent of the Union.

In March 1922 a Plenary Conference of the Central Executive Committees of the Soviet Republics of Georgia, Azerbaijan, and Armenia met to consider the association of the three Republics into the Transcaucasian Socialist Federated Soviet Republic, and in December of the same year their decisions were approved and confirmed by the First Transcaucasian Session of Soviets of Workmen's and Peasants' Deputies.* The boundaries of the Federation included only the Transcaucasian or southern half of the former Vice-Royalty of the Caucasus, and excluded both Daghestan and the districts ceded to Turkey by the Treaties of Moscow (16 March 1921) and Kars (13 October 1921). The frontiers of the Federation with the Russian S.F.S.R. and with Turkey may be considered in conjunction with the specific boundaries of the different Republics.

Boundaries of the Transcaucasian Republics.†

GEORGIA S.S.R. (capital Tiflis, which is also the capital of the T.S.F.S.R.) comprises the former Government (Guberniya) of Tiflis [with the exception of the Circuit (okrug) of Zakatali and part of the District (uezd) of Borchalu] and the whole of the former Government of Kutais. There are three lesser units either united with or included in the Republic.

(a) The small Abkhaz people, numbering possibly 100,000, have been constituted into the Abkhazia S.S.R. (capital Sukhum), which is united by treaty with Georgia S.S.R.‡ The Abkhazian Republic comprises the Region (raion) of Gagri, and the four Districts of Gudauti, Gumist, Kodor, and Samurzakan.§ The Abkhaz, who find mention in many ancient writers from Strabo to Evliya, are among the most interesting

* Zumbadze, 'Constitution of the T.S.F.S.R.' Tiflis, 1923.

† For further details the reader is referred to the following publications (in Russian):

- (1) A. F. Lyaister and G. F. Chursin, 'A Geography of the Caucasus: The Country and its Peoples' (pub. Trans-C. Comm. University, Tiflis, 1924).
- (2) 'Transcaucasia: A Statistical-Economic Compilation' (pub. Higher Economic Council T.S.F.S.R., Tiflis, 1925).
- (3) 'Informationer (Ит. Spravochnik) for the T.S.F.S.R.' (Tiflis, 1926).

It is a point of interest that in recent publications the Soviet Government has adopted, for purposes of linguistic classification, the "Japhetic Theory" of Professor N. Y. Marr of Leningrad. See Lyaister and Chursin, pp. 269-340, and also current publications of the Russian Academy of Sciences (in the Society's Library).

‡ F.O. Blue Book, p. 9, states that Georgia "includes" A.S.S.R. Abkhazia. The status of Abkhazia, in being formally united by treaty with Georgia, is in theory slightly different from that of A.S.S.R. Ajaristan, which is included in Georgia.

§ *Ibid.*, p. 9, has "six districts in the former Province of Sukhum."

of Caucasian tribes. Their language has affinities with the Kartvelian (Georgian) group and is on the other side, remotely connected with the various dialects of the Circassians (Cherkes) and the Kabardins.

(b) The Georgian-speaking Mussulman hill-men, along the Turkish frontier, have been constituted into the Ajaristan* Autonomous S.S.R. (administrative centre Batum), in which are included the seven Regions of Kobuleti, Chakva, Batum, Ajari-Tskhali, Kedi, Khuloi, and Skhalti.

(c) The districts north of Gori, whose Ossetian inhabitants were always a source of anxiety to the Tiflis nationalists, form the Southern Ossetia† Autonomous Province. The administrative centre of Southern Ossetia is Tskhinvali, and the Province comprises parts of the Regions of Gori, Dushet, Shorapan, and Racha.

The northern boundaries of Abkhazia S.S.R. and Georgia, that is, of the Transcaucasian S.F.S.R., follow the small river Psoi, falling into the Black Sea between Sochi and Gagri, and in a general direction east-south-east, continue along the watershed of the Western Caucasus to the sources of the Kodor and the Ingur.

Immediately south-west of Adai Khokh, the boundary as between the Russian and the Transcaucasian Federated Republics makes a considerable southward loop, which leaves in Russian hands the peak of the important Mamison Pass. The boundary cuts across the Georgian Military Road at a point south of the post of Lars, leaving Kazbek and the Daryal defile in Georgia. East of Daryal the boundary takes an east-north-easterly direction, covering the territory of the Georgian-speaking Tushes and Pshavs, and bringing the headwaters of the Argun and of the Andi-Koisu within Georgian territory. At a point north-east of Dano it curves sharply south, and then runs east-south-east along the watershed of the Avari-Koisu and the Alazan.

The eastern boundary of Georgia with Azerbaijan follows the old local boundaries of the Districts of Signakh and Tiflis; and that with Armenia follows the former boundaries between the Governments of Tiflis and Erivan, with the exception that the Circuit of Lori, formerly in the Georgian District of Borchalu, is now part of the Armenian District of Bambak.

The southern frontier of Georgia contiguous to that of Turkey is of great interest.‡ Here, by the Treaty of Kars, the frontier has been restored as it was before 1877, except that the small region round Batum is still included within the Soviet Union. The recent history of this country has been chequered. By the Treaty of Brest-Litovsk the

* F.O. Blue Book, p. 9, gives spelling Ajaria, "comprising the former Batum Province." Parts of the Province of Batum were ceded to Turkey by the Treaty of Kars (see p. 435).

† *Ibid.*, p. 9, has "The Autonomous Region of Yugo-Osetie."

‡ See *Geographical Journal*, June 1923.

territory, including Batum, was ceded to Turkey. Ottoman troops occupied all the ceded territory, and also Akhaltsikh, Akhalkalaki, Atskura, and Ozurgeti, in the first month of 1918. Only German intervention checked their advance on Tiflis, and persuaded them to concentrate their attention on Baku and the Eastern Caucasus. Under the terms of the Armistice the Turks withdrew, and the Armenians occupied most of the disputed territory, with the exception of Artvin and Ardanuch, which fell to the Georgians. In 1920, when the Turks attacked the Armenian Republic and recaptured Kars, the Georgians entered Ardahan. A few months later, when the Russians invaded Georgia, the Turks occupied Artvin, Ardanduch, and Ardahan without resistance, and advanced to Batum, whence after a skirmish with Soviet troops they again withdrew.

By the Treaty of Kars the Turks evacuated only Alexandropol (Leninakan).^{*} They were confirmed in the possession of the District of Artvin, the southern part of the Batum District of the Province of Batum, the whole of the Province of Kars, and the Surmali Region of the Government of Erivan. The whole area is estimated to represent about 18,000 square miles. The frontier is still subject to delimitation, and as late as last July a Turkish Boundary Commission was working in Tiflis.[†]

The provisional Georgian-Turkish frontier, beginning at the village of Sarp, on the Black Sea coast, just south of Batum, goes east until it crosses the river Chorokh near the village of Maradidi. It then penetrates the southern part of the Shavsheti range to the northern boundary of the former Circuit of Artvin; following this boundary and the northern boundary of the former Circuit of Ardahan, it cuts across the Lake of Khodzapin, to the mountain of Uch-Tapalyar, where the frontiers of Georgia, Armenia, and Turkey converge. This region with the Laz districts of Turkey, extending as far as the hinterland of Trebizond, forms the home of exceedingly intractable Georgian-speaking Mussulman tribes. The Ajars rose against the Russians in 1877 and again in 1914 and 1917, and in 1918-19 they were a constant source of trouble to the Tiflis Government. The Ajars at present remaining within the boundaries of Georgia receive particularly favourable treatment from the Soviet Government, and they show no immediate anxiety to join their recently "liberated" co-religionists across the Turkish frontier. They are aware of the economic decay which has fallen on the districts ceded to Turkey, and when I was among them last summer they were congratu-

^{*} Many place-names in the Caucasus have recently been altered, both on national and political grounds. Alexandropol [formerly (1826) Gumri (? Gimri—Kimmerians)] is now Leninakan. Khankend = Stepanakert (? from Stepan Shaumian, a noted Armenian Communist); Elisavetpol = Ganja (old Armenian Kantzak); Petrovsk = Makhach-Kala; Mikhallovo = Hashuri; Ekaterinodar = Krasnodar; Temir-Khan-Shura = Buinaksk, etc.

[†] The latest information is that the work of the Commission is now complete.

lating themselves upon being beyond the scope of Kemal's "hat decree." They are keen hunters, and also inveterate smugglers, doing a roaring trade in contraband in Batum, Akhaltsikh, and the surrounding districts.

AZERBAIJAN S.S.R. (capital Baku) comprises the whole of the former Government of Baku and the former Government of Elisavetpol (Ganja), with the exception of the District of Zangezur, and part of that of Kazakh, and includes the Zakatali Circuit of the former Government of Tiflis.

Mountain Qarabagh Autonomous Province (administrative centre Khankend, now Stepanakert) has been constituted to give local self-government to the Armenian majority which inhabits parts of the former Districts of Jevanshir, Shusha, Qarayaz and Kubatli. A minor autonomous division has been formed within this in order to give representation to groups of Kurdish villages in the western parts of Jevanshir and Shusha, and northern Kubatli.

These Qarabagh Armenians are a particularly fine type, renowned throughout the Caucasus, and indeed in Russia, for their military qualities. Until the middle of the eighteenth century they maintained their independence under their own Meliks, who took part in the Transcaucasian Campaign of Peter the Great (1722). Qarabagh has given many famous leaders to the Russian army, including Lazarev, Loris-Melikov and Tergukhasov. The famous partizan leaders of the late war, Murad and Nazarbekian, came from the Qarabagh. Hanoyan, the present Chairman of the Central Executive Committee of the T.S.F.S.R., comes from Qarabagh, and also General Gaïsh, one of the best-known Soviet cavalry leaders. The region is rich in historical remains, which are at the present time being investigated by a Russian Scientific Expedition.*

Nakhichevan Territory† is a political curiosity. It forms a triangular "enclave" within Armenia S.S.R., and adjoins the Persian Araxes frontier. The population contains a substantial Tatar majority, and for this reason it has been excluded from Armenia S.S.R. and placed under the protectorate of Azerbaijan S.S.R. It covers the territory of the former District of Nakhichevan, and contains the towns of Nakhichevan, Julfa, Ordubad, and Bash-Nurashen. It is of some strategic importance, since Julfa forms the terminus of the Caucasian railway system, and controls communications with Tabriz and Persian Azerbaijan. Julfa will also form the junction of the proposed new line which will link Baku direct with Tabriz and Erivan.

The northern boundary of Azerbaijan with Daghestan A.S.S.R. continues in a south-easterly direction along the watershed of the Alazan and the Samur, until north-east of Nukha it curves east, and then

* F.O. Blue Book omits reference to Mountain Qarabagh.

† F.O. Blue Book describes Nakhichevan as an "Autonomous Province."

north-east, meeting the Samur at the village of Ermolovski, and keeping the course of that river until its debouchure in the Caspian.

The southern frontier of Azerbaijan follows the old Russo-Persian frontier of 1914: the river Astara, the Talish chain—Belyasuv—whence it cuts due north-west across the Mughan Steppe, to its junction with the Araxes, which it follows to the Armenian boundary, where the small district of Megrin alone separates Azerbaijan from its autonomous protectorate of Nakhichevan.

ARMENIA S.S.R. (capital Erivan) includes the former Government of Erivan, with the exception of the Districts of Surmali (Turkish) and of Nakhichevan. It includes also, from the former Government of Elisavetpol (Ganja), the District of Zangezur, and part of the District of Kazakh, formed by the Region of Delijan. The Lori Region, formerly part of the Government of Tiflis, is also included in Armenia.

Armenia has suffered a reduction of approximately half her extent as a result of the political developments of 1920-21. She has lost the whole of the old Government of Kars, besides outlying districts. Her two chief centres of population—Erivan and Alexandropol—(now Leninakan) are within gunshot of the Turkish frontier. The sacred mountain of Ararat is once more in Turkish hands, as are also the ruins of the royal city of Ani. Finally, the Armenians have had to abandon all prospect of acquiring the rich plain of Alashkert, where they might have settled the thousands of their refugees.

The new Armeno-Turkish frontier—the old Russo-Turkish frontier of 1877—runs in a south-easterly direction from the junction of the Georgo-Turkish frontier round Uch-Tapalyar. It follows the small but historic stream of the Arpa Chai (the Barley river) to its junction with the Araxes. The Araxes continues to form the frontier between the Soviet Union and Turkey, to the convergence of the three frontiers north-east of Mount Ararat. The boundary of Armenia S.S.R., enclosing the Nakhichevan Territory, touches the Araxes again a few miles below Ordubad.

Administrative Areas north of the Caucasus.

The Soviets, in pursuance of the policy of decentralization on a national basis, have divided the northern and north-eastern parts of the former Vice-Royalty into one Autonomous Socialist Soviet Republic and a number of autonomous provinces.

DAGHESTAN A.S.S.R., established by decree January 1921—capital Petrovsk (now Makhach-Kala)—comprises the former Province of Daghestan, the Khasav-Yurt Circuit of the former Province of Terek, and parts of the Province of Terek and of the Government of Stavropol inhabited by the Qara-Nogai Tatars. The Daghestan A.S.S.R. thus includes a great expanse of steppe, and its frontiers stretch from the Kuma to the Samur.

The principal tribes included in the Daghestan A.S.S.R. bear names celebrated in the Mountain War, and immortalized in Mr. J. F. Baddeley's "Russian Conquest of the Caucasus." Not less than twenty-five different languages are spoken in the mountains, and they may be divided into five principal linguistic groups. The present numbers of the mountaineers as estimated by Lyaïster and Chursin (1924) are of interest: (1) Avars (234,000); (2) Laki (Lesghi) or Kazi Kumuks (90,000); (3) Dargis (130,000); (4) Kiurins (215,000); (5) Andis and Didos (45,000).

The various tribes scattered over the country between the estuary of the Kuban and middle reaches of the Terek, have been grouped into separate Autonomous Provinces. These are (1) Adighe-Circassia A.P., occupying a narrow stretch of country along the left banks of the Laba and the middle Kuban (administrative centre Ekaterinodar, now Krasnodar*); (2) Qara-chai†-Circassia A.P., inhabited by Turks and Circassians (Cherkes) scattered over the northern slopes of the Western Caucasus along the valleys of the Urup, the Zelenjik, and the Teberda (administrative centre Batalpashinsk); (3) Kabarda-Balkaria A.P., inhabited by "mountain Tatars" who are settled on the northern side of the Central Caucasus over the valleys of the Baksan, the Chegem, and the Uruk (administrative centre Nalchik); and (4) Chechnia A.P., inhabited by the Chechens of the former administrative Circuit of Grozni.‡ The Ossetians, the Ingushes, and the Sunja Cossacks, inhabiting the districts round Vladikavkaz, constituted from January 1921 to June 1924 the Gorskaya A.S.S.R. The Gorskaya Republic has now been liquidated, and there have been established the Northern Ossetia A.P., Ingushetia A.P., and Sunja Circuit. The administrative centre of these Autonomous Provinces is Vladikavkaz, which itself enjoys a special *régime* as a "free town." The same kind of *régime* has been applied to Grozni, which is the administrative centre of the Chechnia Autonomous Province.

The rest of the old Vice-Royalty of the Caucasus, comprising most of the old Government of Stavropol and parts of the former Province of Terek and of the Black Sea Government, constitute an administrative unit known as the North Caucasus Territory. Parts of the former province of the Don Cossacks are in this Territory, which is included in the Russian S.F.S.R., and is in enjoyment of no peculiar *régime*.

To conclude, the present Soviet policy of autonomy and decentralization, which is at least effective in the spheres of language and local

* F.O. Blue Book gives capital as Tokhtomukai (p. 7). Soviet Year Book (1926) and other Russian publications give Krasnodar.

† F.O. Blue Book, p. 7, gives spelling "Karachaev," and describes the inhabitants of Kabarda (Russ. Kabardintsi, Eng. Kabardins or Kabards) as "Kabarda."

‡ F.O. Blue Book, p. 7, states that the "Chechensk Region is formed from the Chechensk district (?) of the Gorski Republic." No Russian publication indicates the Autonomous Chechen Territory as having formed part of the now defunct Gorskaya Republic.

culture, gives promise of being an experiment of absorbing interest. The political results cannot be foreseen, and may not become evident before many years have elapsed. It may be said, however, that the new trend towards the autonomy of nationalities within the Union is not a mere essay in cartographical fantasy, but represents a considered policy, which is intended to counter, and in some cases actually anticipates, a new consciousness of national individuality among those many groups of varied racial composition and of different degrees of culture who find themselves within the borders of the Soviet Union.

NOTE ON THE TRANSLATION OF RUSSIAN ADMINISTRATIVE TERMS

The question of the translation of Russian administrative terms is exceedingly complicated, and to the best of my knowledge no standard method has ever been adopted. For example, the word *Oblast'* is rendered by different authorities "Province," "Territory," "Region." If we take into consideration the general Russian usage of the various words, the following are perhaps the most satisfactory translations :

GOVERNMENT, *Guberniya* : formerly applied to the largest administrative unit of the Russian Empire and retained as an administrative term by the Soviets. There are no Governments in the Caucasus now.

PROVINCE, *Oblast'* : formerly having a more military implication than *Guberniya*, and originally applied to outlying territories in Siberia, Turkistan, and the Caucasus, e.g. Maritime Province, *Primorskaya Oblast'*. It is also the ordinary Russian word for "province" in the figurative sense, e.g. "the province of geography." (The word *Provintsiya* is used of a Province in a foreign country.)

TERRITORY, *Krai* : primarily meaning "border," then "border country," "march" (German *mark*), and finally simply "country" as in the phrase "foreign countries." "Country," however, is too vague a term for a definite political area.

DISTRICT, *Uezd* (pronounced *U-yésd*) : the ordinary subdivision of a Government, *Guberniya*.

CIRCUIT, *Okrug* (from the preposition *o* = round and *krug* = circle) : originally having the same relation to *Oblast'* as *Uezd* had to *Guberniya*, but now apparently interchangeable with *Uezd*.

DIVISION, *Otdel* (pronounced *Atdyél*) : formerly used instead of *Okrug* for a subdivision of an *Oblast'* in certain cases, as in the old Kuban Province. It has a distinctly military significance.

These are the main political areas. Smaller units, not usually shown on Russian maps, are :

Canton, *Volost'* : an aggregation of villages, somewhat like our Hundred or Rural Deanery.

Region, *Raion* (from the French *rayon*): apparently the same, with a military implication, originally meaning a group of connected forts. It is also the word ordinarily used in such a phrase as "gold-bearing region."

The following abbreviations for the titles of autonomous or semi-autonomous areas appear to be in use in the Union of Socialist Soviet Republics (U.S.S.R.), *Soyuz Sotsialisticheskikh Sovetskikh Respublik* (S.S.S.R.).

S.S.R. = Socialist Soviet Republic, *Sotsialisticheskaya Sovetskaya Respublika*.

F. (inserted between the two Ss of the foregoing) = Federated, *Federativnaya*.

A. (sometimes before and sometimes after the distinctive name) = Autonomous, *Avtonomnaya* (often abbreviated *Aut.*).

P. (anglice) = Province, *Oblast'* (O., but often abbreviated *Obl.*).

The distinctive name in the Russian form is either (i) an adjective with masculine ending *-skii* (to agree with *Krai*, *Uezd*, *Okrug*, *Otdel*, *Raion*) and feminine ending *-skaya* (to agree with *Respublika*, *Guberniya*, *Oblast'*, *Volost'*); or (ii.) a substantive in apposition in the nominative case, e.g. *Avtonomnaya Oblast' Ingushetiya*. In the translations here given an attempt has been made to use substantives only. The termination *-o* to the first part of a compound name is similar to the English usage in "Anglo-Egyptian," "Indo-China," etc.

Names which are pure Turkish words, as *Daghestan*, *Qarabagh*, *Qarachai*, are here transliterated as from Turkish, not as from Russian.

POLITICAL DIVISIONS OF TRANSCAUCASIA, S.F.S.R.

Zakavkazskaya, S.F.S.R.

AZERBAIJAN S.S.R. *Azerbaidjanskaya S.S.R.*

Azerbaijan.

Mountain Qarabagh A.P. .. *A. O. Nagorni Karabakh.*

Nakhichevan Territory .. *Nakhichevanski Krai.*

ARMENIA S.S.R. *Armyanskaya S.S.R.* (or *S.S.R. Armeniya*).

GEORGIA S.S.R. *Gruzinskaya S.S.R.* (or *S.S.R. Gruzija*).

East Georgia *Vostochnaya Gruzija.*

West Georgia *Zapadnaya Gruzija.*

Abkhazia S.S.R. *Abkhazskaya S.S.R.* (or *S.S.R. Abkhaziya*).

Ajaria (or Ajaristan) A.S.S.R. *A. Adjariskaya S.S.R.* (or *A.S.S.R. Adjaristan*).

Southern Ossetia A.P. .. *Yujno-Osetinskaya A. O.* (or *A. O. Yugo-Osetiya*).

POLITICAL DIVISIONS ADJOINING TRANSCAUCASIA S.F.S.R.
ON THE NORTH, BEING PART OF RUSSIA S.F.S.R. (FROM EAST
TO WEST.)

DAGHESTAN A.S.S.R.	..	..	<i>A. Dagestanskaya S.S.R.</i>
CHECHNIA A.P.	..	..	<i>Chechenskaya A.O.</i> (Containing Grozni, town with provincial status.)
SUNJA CIRCUIT	..	..	<i>Sunjenski Okrug.</i> (A very small area not actually ad- joining Transcaucasia S.F.S.R.)
INGUSHETIA A.P.	..	..	<i>A. O. Ingushetiya.</i> (Containing Vladikavkaz, town with provincial status.)
NORTHERN OSSETIA A.P.			<i>Severo-Osetinskaya A.O.</i>
KABARDA-BALKARIA A.P.			<i>Kabardino-Balkarskaya A.O.</i>
QARACHAI-CIRCASSIA A.P.			<i>A. Karachaevo-Cherkesskaya O.</i>
ADIGHE-CIRCASSIA A.P.	..	..	<i>A. Adigeisko-Cherkesskaya O.</i> (A very small area not actually ad- joining Transcaucasia S.F.S.R.)
NORTHERN CAUCASUS			
TERRITORY	..	..	<i>Severo-Kavkazski Krai.</i>
Maikop Circuit	..	..	<i>Maikopski Okrug.</i>
Black Sea Circuit	..	..	<i>Chernomorski Okrug.</i> (Several other circuits not adjoining Transcaucasia S.F.S.R.)

The foregoing note on the translation and transliteration of Russian administrative terms and names has been thoroughly discussed with and revised by Mr. J. H. Reynolds, Secretary of the P.C.G.N., to whom my most grateful thanks are due. We hope that the result may serve a useful purpose in bringing a very tangled subject into provisional order for English use.

NOTE ON A MAP OF THE BRITISH ISLES BY
PIETRO COPPO

Prof. Roberto Almagià

THE map of the British Isles here reproduced for the first time is a wood engraving, hitherto entirely unknown, of which the only copy discovered down to the present moment is preserved in the Municipal Library of Pirano, in Istria. Although it bears neither the name of its author nor a date, it is quite safe to say that it was the work of Pietro Coppo, probably about 1525.

Pietro Coppo or Copo is fairly well known as a geographer and

cartographer; born at Venice in 1469 or 1470, he nevertheless spent nearly the whole of his life at Isola, in Istria, where he followed the profession of notary (*notarius et iudex ordinarius*), holding also other public offices. He certainly travelled over the whole of Istria by sea and by land, and knew the country perfectly; possibly he made other journeys also. He died at Isola at the end of 1555 or the beginning of 1556.* His best-known work is a "Portolano" of minute size, printed at Venice by Bindoni in 1528, which has now become extremely rare.† It has at the end a printed planisphere of characteristic design, reproduced in the 'Raccolta Colombiana,' and also in Nordenskiöld's 'Facsimile Atlas' (p. 103). Coppo afterwards wrote also a description of Istria ('Del sito de l'Istria'), printed at Venice in 1540, and accompanied by a map of that country, which, subsequently reproduced several times in good copper-plates, is to be found also in the so-called Lafreri Atlas; it is the best and most famous map of Istria of the sixteenth century.‡

But Coppo's most important work has remained unpublished to the present day. It is a description of the world in Latin, in four books, entitled 'De toto orbe,' or 'Cosmographia,' of great value for the history of geography in the sixteenth century. Of it the author himself composed a summary, with the title 'De Summa totius orbis.'

Of this work, or its summary, I at present know four manuscripts:

I. National Library at Paris, Fond. Lat. 9663. This contains the work 'De Toto Orbe,' divided into four books (fol. 1-202); then the 'Summa totius orbis' (fol. 204R.-242V.) and the Portolano, in a text agreeing with that printed at Venice; lastly, also an Italian version of the 'Summa totius orbis.'

II. Communal Library at Bologna, A 117. This MS., which contains the text of the 'De Toto Orbe,' has recently been described by C. Lucchesi, 'Inventario dei Manoscritti della Biblioteca Comunale di Bologna,' Series A (Florence, Olschki, 1924, p. 59).

III. St. Mark's Library at Venice, Cod. Lat. X. 146. This contains only the 'Summa totius orbis,' that is, the summary of the larger work.

IV. Municipal Library at Pirano. This MS. contains the 'Summa totius orbis' and the 'Portolano.'

The Paris and Venice MSS. contain no geographical maps. On the other hand, the Pirano MS. is accompanied by fifteen woodcut maps, and that at Bologna by twenty-two maps drawn and coloured by hand, which, taken together, constitute a really original modern atlas, worthy of detailed study, as would also be the text of the 'De toto orbe.' It includes a chart of the celestial spheres, two mappæmundi, nine maps

* On Coppo's life and writings, see Attilio Degrassi, "Di Pietro Coppo e delle sue opere," in *Archeografo Triestino*, III. Serie, vol. xi., 1923.

† I have seen only the copy preserved in St. Mark's Library at Venice. Another is to be found in the British Museum. See Harris, 'Bibliot. Americana vetustissima,' sub anno 1528.

‡ This description of Istria has been printed by Degrassi in the work quoted above.

of Europe (among them one of the British Isles), one of the New World, three of Africa, and six of Asia. The woodcut maps of the Pirano MS. correspond in part only to the hand-drawn maps of the Bologna codex: the map of the New World is missing, as also those of Africa, and there are only three of Asia. On the other hand, there are two special maps of Italy and one of Istria which are not in the Bologna codex. It is probable that the Pirano set is incomplete, and that some of the maps have been lost.

It must be noted besides that while the maps annexed to the Bologna MS. have neither signature nor date (the codex itself is undated) some of the Pirano maps have engraved the signature, or at least the initials, of the author, and some the date also. For instance, one planisphere bears along the upper margin the title: "Orbicularis totius terræ et maris figuratio impressa MDXXIV.," and at the bottom the signature "Petrus Coppus F." Similarly the map "Italia, Illyricum Epirus Greta et Mare Egeum. Impressa MDXXIV." has the same signature. A map of the island of Candia has the indication "P.C.F. nel 1526," while the maps of Spain and France have only the initials of the author. Since all the maps are composed in the same style and on the same plan, we may confidently conclude that also the maps which lack the author's name (as does that of the British Isles) are nevertheless the work of Coppo and of the same period (1524-26).

The map of the British Isles in the Pirano Codex, here reproduced in facsimile, measures in the original about 35.3 × 26.5 cm. It is folded in two in the MS. and is somewhat damaged along the fold, as may be seen from the photograph. It is the third in the codex, coming immediately after the two planispheres. In the Bologna codex there is likewise a map of the British Isles (the fourth, following the planispheres and the star-map) very similar to the printed map as regards construction, orography, and hydrography; it has all the names in Latin, however, but the nomenclature is the same.

I do not propose to examine the contents of the map in detail here. It will be enough to observe that it combines two elements of diverse origin. The design of the coasts, with the many and deep bays, the river estuaries, the small islands and rocks, are certainly taken from a nautical chart. Other features too disclose a similar source: for example, the separation of England and Scotland by a narrow channel, which is met with in various nautical charts, especially of the fourteenth century (*Atlante Mediceo*, 1351; *Pinelli-Walckenaer Portolano*, 1384; *Upsala Nautical Chart* in *Nordenskiöld's 'Periplus,'* plate xix., etc.; also the great gulf filled with islands (Clew Bay) on the west coast of Ireland.* But the nautical chart used as a base is notably different from that followed either by *Bernardo Silvano* for his 'Britannia' of 1511, or by the author

* For this feature see T. J. Westropp, "Early Italian Maps of Ireland," in *Proc. R. Irish Acad.*, vol. 30, sect. C, No. 16, 1913.

of the 'Tabula Nova Hiberniæ Angliæ et Scotiæ,' which appeared in the Strasbourg Ptolemy of 1513.* As a whole, the picture of the outlines which we see in Coppo's map is inferior to that of either of the other two maps here mentioned.† The other element in the map consists of data derived from Ptolemy. From this source, for example, are taken many names of watercourses,‡ and also of the inhabited centres, especially in the interior; Ptolemy is recalled too by the names of peoples, which have retained the classical form, and by certain other indications, such as the "Caledonia Silva" in Scotland and the words "Victrix Legione" in the centre of England, a curious denomination which seems to derive from a faulty interpretation of a passage in Ptolemy (Book 2, chapter iii. §§ 10, 11), where mention is made of "Legio VI. victrix" and "Legio XX. victrix." But besides the Ptolemaic names there are also a few modern names of inhabited places, especially along the coasts of England and of Ireland. I hope that the complete study of the names in this interesting map may before long be made by another. He will, I think, be able to confirm the view that Coppo's map, like many other regional maps of the first half of the sixteenth century, is the result of a combination of ancient and modern elements—a combination which was not always a success. Bernardo Silvano in his map of 1511 reproduced Ptolemy's nomenclature pure and simple, restricting himself to correcting the outlines of the islands, especially on the base of the nautical charts. The 'Tabula Nova' of the Strasbourg Ptolemy of 1513 introduces on the contrary a modern nomenclature, but only for the coasts, for it gives only a minimum of names in the interior. Coppo's map gives a much more extensive nomenclature, even for the interior, and may be therefore considered to occupy a position in the cartographical history of the British Isles intermediate between the map of 1513 and the famous map of Lily (1546), which is the most important document in the cartography of the Archipelago during the whole sixteenth century.

Note: We are indebted also to Professor Almagià for a list of the names, many of which are rather indistinct in the photograph. This list will be incorporated in the study of the place-names of this interesting map which has been promised us for early publication.—ED. G. F.

* For Silvano's map of Britannia see G. Guglielmi-Zazo, "Bernardo Silvano e la sua edizione della Geografia di Tolomeo" in the *Rivista Geogr. Italiana*, 1925, pp. 48-52. The Tabula Nova of the Strasbourg Ptolemy is reproduced in Norden-skiöld's Facsimile Atlas, p. 11.

† Coppo's design does not agree with any one of the three types which according to H. Inglis represent the most ancient versions of the picture of the British Isles ("Early Maps of Scotland and their Authors," in *Scottish Geog. Mag.*, 1918, pp. 217 et seq.).

‡ The trace of these in the interior is purely arbitrary, as is also the representation of the mountains.



in the Municipal Library of Pirano, Istria

THE TUAREG

The People of the Veil: being an account of the habits, organization and history of the wandering Tuareg tribes which inhabit the mountains of Air or Asben in the Central Sahara.— **Francis Rennell Rodd.** London : Macmillan & Co., Ltd. 1926. 10 × 6½, pp. xvi. + 504. *Map and Illustrations.* 30s. net.

CONSIDERING that so much of it is not very far distant from Europe, the northern half of the continent of Africa has not received the attention it deserves from ethnologists, if we except the Nile Valley and some portions of the North African seaboard. Detailed studies of the races of Northern Africa have remained scanty because access to the Sudan was, until recently, attended by hardships and difficulties, and because the major portion of the northern half of the continent is of such a sterile and waterless nature, that the most ordinary comforts of travel can only be obtained by organized expeditions. The ethnological problems involved are however probably second to none in interest. The sidelights which have been thrown upon the Sahara and Sudan in past ages have come from such different angles of vision that the task of general survey is a difficult one, demanding on the part of the surveyor an all-round knowledge of ancient, mediæval, and oriental history, coupled with a present-day knowledge of the different parts of the whole, which is difficult to find combined in any one savant or ethnologist. The problem, however, is in many respects one and indivisible.

Northern Africa is a stretch of the Earth's surface with few geographical barriers. Races have roamed its deserts in all directions: tribes have fused with tribes, and the cultures of the north and east have, usually in an attenuated form, spread consistently southwards and westwards towards the equator. Thus the faces of the peoples of the Sudan and Sahara have been always set towards the north and east, their cultural home of origin. The line of the equator on the other hand was, so to speak, a blank wall, and what was beyond it unknown to them.

Perhaps the greatest service which Mr. Francis Rodd's book renders to students of the history and ethnology of Africa is that he is the first to set forth in one very readable volume both the magnitude of the problem and its complexity, while delineating vividly the romantic side of the life of the people to whom the work mainly relates. He includes a description of one portion of their country, the region of Air and Damargu, portrayed with freshness and enthusiasm.

The "People of the Veil," commonly called Tuareg, are a race or caste of nobility who, at any rate since 500 A.D., have roamed and ruled the Sahara. They are white in skin colour, of magnificent physique, and have, as no other African people has, the traditions and bearing of an aristocracy. They count descent through their mothers, and inheritance passes through females, who are socially the equals, if not superiors, of the men, and are unveiled; while, on reaching manhood, in the full sense of the term, every noble male wears for the rest of his life by day and night a "vizar" of cloth (the so-called veil) which covers his face except for a narrow slit through which he is able to see.

The interesting question with which Mr. Rodd's book largely deals, is who are these Saharan nobles, Imajegh or Imoshek as they call themselves in their own language (Tamashék), and whence did their peculiar dress, customs, and social order come? These are difficult questions, and can only be briefly touched upon here. For further details, reference may be made to Mr. Rodd's

paper in the *Journal* for January 1926, and to the writer's notes in the *Journal*, November 1926, pp. 412-18.

In chapter iv. he describes and discusses the social organization of the Tuareg into two or, as is more often stated, three classes. These are the nobles, imajegh, and the servile tribes, imghad. They, with the slaves proper, ikli, who in the main are negroes, make up the nation.

Though the age-long propinquity of Egypt may account for much in the present-day Tuareg social order, and North African and Syrian influences which are emphasized by the Arab historian Ibn Khaldun, may account for much more, these influences do not seem to account either for the physical type of the Tuareg and their ritual veil, nor yet wholly for what may be termed their "chivalry," though the word must be understood in connection with them to connote ideas other than those the term connotes in Europe.

We can trace, as Mr. Rodd does, the present Tuareg nobles of Aïr and the Upper Niger region to a habitat in the Azger plateau and in Fezzan about the opening of the Moslem era, but there is no reliable evidence that these same races, whatever may be said about some aspects of their culture, extended farther west before that era, or in fact that they lived in Fezzan before the end of the first half of the first millennium A.D.

In this connection the names by which tribal units are known now, or were known in past ages, are a very uncertain guide or indication of continuous ethnical homogeneity, and one is inclined to think that Mr. Rodd builds too much on supposed continuity of tribal composition as indicated by similarity of names. For instance, such names as Ifuraces, Ifoghas, Ifrikish, etc., are merely, it is thought, variants of the common noun "Bar," "man," which makes plurals Barak, Burâk, Bar-ku, etc.

If we go back to the opening of the Christian era, we find in the Eastern Sudan a people of whom the Greek and Roman classical authors wrote very much as Mr. Rodd writes of the Tuareg. They were pre-eminently an aristocracy, and such epithets as *δυνάμεις* and *σηπτοῦχοι* are applied to them by the Greek authors. Romances were written about them by Latin writers, and they were so remarkable in appearance that they attracted the curious gaze of a Roman audience at a Triumph. Their name to the Romans sounded Blemyes or Balhemu, the equivalent according to Dozy of the Arab geographer Idrisi's Al Belium, *i.e.* Beli or Berbers of Ennedi and Wadai. Since from these same Beli and their allied race the Zaghawa (whom Ibn Khaldun labels as "people of the veil") came the Berber rulers of Kanem (Kanuri), whom the modern Tuareg still call Izaghan (sing. Izghi)—which is simply another form used to denote Zaghawa in contrast to the Ikaradan (Gara races or Garawan, ancient Garamantes)—it would seem that there is a very fair *prima facie* reason for believing that the Blemyes, Beli, Izgham (Zaghawa), and Muleththemin (Tuareg) are or were racially much the same and derived their distinctive culture from the same source.

It is at least a possible hypothesis that the "veil" and the Christian symbols which the Tuareg use came from the Nile Valley or east of it, while, on the other hand, other parts of their culture were derived from their predecessors or the Libyans of North Africa, with whom they perhaps fused in Fezzan after their expulsion from the Nile Valley when crushingly defeated by the Romans and Silco King of the Nobatac between 400-500 A.D. A notice in Evagrius concerning Blemyes and Maxyes (Imajegh) in the oases west of Egypt about 400 A.D. rather suggests that such was the case.

Mr. Rodd touches briefly on the vexed question of the date of the intro-

duction of camels into the Sahara, and has some interesting remarks on Tuareg architecture. Concerning the "argem" type of tomb of the Tuareg, which also occurs farther north, he records Gsell's view that they are fairly late in date.

Perhaps the most interesting chapter in the book is chapter ix. on "Religions and Beliefs." Mr. Rodd writes: "There is no doubt that underlying all their Islamic practices they hold fundamental beliefs drawn from their earlier religious practices, regarding which only very few indications are available. Duveyrier and other authorities assert that the Tuareg were Christian before they were converted to Islam, and I am prepared to accept this view in spite of the denials which have been expressed by so eminent a writer as Bates." May not the solution be that Bates was chiefly concerned with the Libyans proper of North Africa, whereas the Christian influence observable among the Tuareg may have come from the Upper Nile and not from North Africa? It seems to the writer that Mr. Rodd possibly attaches insufficient weight to Bates' conclusions as to the early religious beliefs of the Saharan Berbers. He does not mention the various notices in Arab authors which show that from 500 A.D. onwards to 1000 and longer, the Berbers east of the Tibesti range were, first, worshippers of the sun, moon, and stars; and then in some measure followers of the Christian Jacobite heresy from the time of the Empress Theodora.

The most common Tuareg cross (illustrated on p. 276) is not unlike the Egyptian ankh sign, and it is significant that just as the Tuareg men wear the "veil" day and night, so a Tuareg woman will not willingly take off this particular form of cross, though the ordinary Latin cross is treated as a mere ornament. On the other hand, the "talhakim" triangle mentioned on page 282 seems rather to be due to Phœnician or possibly Cretan influence.

Concerning the "veil" Mr. Rodd truly says, "The veil will be found wherever the Tuareg live, and only when the riddle of their origin is solved will an explanation be forthcoming. Since the veil is sometimes not donned until the mature age of 25 years and in no case is it worn until several years have elapsed after the sword is first worn, its ritual origin cannot be doubted." Nor, it may be added, is there any doubt that the proper and original ritual of the nobles demanded a black or indigo veil—not a white one. In this connection the references in Idrisi's geography to the Al Beluun, whom Dozy rightly holds to be the people called by the ancients Blemyes, is illuminating. Idrisi speaks of Nubia being subject to the *rhazzias* of "Kheil al Sudan, called Al Beluun." Dozy translates these words "black horsemen," but, in the first place, if such was the meaning nothing would have been easier than to express it grammatically, and secondly, the word "Kheil" in the Sudan has usually almost the same meaning as such words as "Knights" or "Chivalry" had in the Middle Ages. The expression "Kheil al Sudan" should mean the "chivalry of the Sudan," and may well include fighters not only on horses but on camels. Sudan may also possibly connote the "black veil" of the raiders, but it can hardly denote the skin colour of the riders.

Hitherto no one has been able to connect the "Tuareg veil" with the ritual of any people ancient or modern of the temperate zone, nor as Mr. Rodd states, is there any mention of it at all before the Arab epoch. On the other hand, the conceptions by Roman geographers of fabulous Blemyes, to whom were cognate the historical Blemyes of the Nile Valley, may well have had their origin in the unique costume of the "people of the veil." To the writer it seems that the most promising field for investigation in this regard lies in the superstitious awe the southern Tuareg feel for trees of the species of "Myrrh"

and "Acacia," to which they apply the epithet "blessed," and from which unsophisticated individuals regard themselves in some cases as descended.

This train of thought suggests the eastern horn of Africa and Arabia Felix as the home of the "veil." Considering that Ibn Khaldun believed that these regions were at least the nearer home of the Muleththemin, the hypothesis is worth examination.

On pp. 322 *seq.* Mr. Rodd discusses the position of the region called by the Romans Agisymba, which has from the time of Duveyrier onwards been thought to denote the Aïr plateau. His arguments in favour of its having been more probably the Tibesti region are weighty, and to them it may be added that the latter part of the word resembles the ordinary Teda word for people, "amba," while, though the word "agus" is now the South Tuareg term for south, it is not at all impossible that it was used in the Garama of the Roman era by the town Garamantes to denote "South." If so, Agus-amba (Agisymba), "south people," would naturally be Tibesti.

It is most probable that "Garama polis," or Jerma, contained a composite commercial population of northern races like all the Saharan entrepôts. The Garamantes of the country were probably quite different people, in fact the ancestors of the modern Teda or Tubu. Mr. Rodd, however, is probably not on sure ground in regarding the place-names Bardetus and Mesche as denoting country occupied by Teda (Tubu) or the Bardoa of Leo Africanus as referring to these same races. The Roman names assigned to mountains in the Agisymba region, Bardetus, Mesche, and Zipta, are more consonant with a Berber if not Tuareg occupation of the southern regions in question than anything else, for while Bardetus or Bardai connotes an area of Berbers, Mesche would appear cognate to such place-names as Damasek, Museku, Tamiske, Amsaka, etc., which are all derived from the Berber -sek or sagh, an "encampment."

There is no reason to doubt Mr. Rodd's inference from a passage in Corippus that John, the Armenian general of Belesarius (*circa* 533 A.D.), fought against the ancestors of the modern Tuareg, but the Circumcelliones, who embraced the Donatist heresy in 345 A.D., may have been any Berbers. To the writer at least it appears very doubtful whether there were any considerable number of Tuareg in Fezzan before the fifth century A.D. It would seem, in fact, as if the Libyans first penetrated the Sahara, and that it was the Lamta (Illam or Blemyes) who absorbed them into Tuareg.

'The People of the Veil' is excellently illustrated, and its concluding chapters are full of information, albeit some of that given about the tribal units can hardly be regarded as sufficiently certain to be accepted as a basis for final pronouncements on the history of the various groups of the present day, or their history in the past. We have still much to learn about these desert peoples, and much to verify, if not correct; but Mr. Rodd's work, full as it is of insight and sympathy, goes to the heart of these problems. If his details are not all above question, he gives a complete and living picture of the Tuareg and their country which will appeal to the imagination of all who are interested in Africa.

H. R. PALMER.

SUMATRA

Terres et Peuples de Sumatra.— Octave J. A. Collet. Amsterdam : Société d'édition "Elsevier." 1925. 11½ × 9, pp. xvi. + 562. *Maps and Illustrations.* *Belgian francs* 110.

THIS handsome quarto of 530 pages is lavishly illustrated by 150 maps, text-figures, graphs, and charming head-and-tail pieces appropriate to the subject of each chapter, as well as enriched by 180 full (mostly double) page plates from photographs of unusual excellence, in addition to a large coloured map on the scale of 1/2,000,000. The book has a bibliography and a good index. The work, written in a clear and attractive style, gained for its author in 1924 (on its first award) the triennial prize "Maurice Rahir" of the Royal Belgian Geographical Society. It possesses, however, two defects: one, that in being heavy, 2½ inches thick, and bound in very flexible art-linen covers (also aptly ornamented with Sumatran *motifs*) it annoys one, unless read on a table, by constantly falling all of a heap in the using; the other, serious from a historian's point of view, is that the author throughout the book nowhere quotes his authorities, leaving the reader in doubt whether his information, occasionally questionable, is from personal knowledge, or from whom, if any, of the authors cited in his extensive, though incomplete, bibliography it is derived.

M. Collet's object has been to produce a monograph, condensing into his pages all the economic, social, family, and industrial life of the people, and to indicate what the Netherlands' domination has done to justify its conquest and colonization of the island. Apart from Marsden's 'History of Sumatra' (1783), Prof. Veth's monograph (1873), and Lekkerkerker's 'Land und Volk von Sumatra,' he claims, and with much justice, that no similar work exists.

The eighteen chapters of the volume fall into two parts: nine of them deal with "Le Milieu"; "L'Ambiance"; "Les Populations"; and nine others describe "Les Régions" into which Sumatra is divided for administrative purposes. The book might have been abbreviated had the second part not repeated much that has been given in the earlier chapters.

Physical Features.—Under "Le Milieu" are discussed "L'insularité"; "Le Sol"; "La Vie."

Sumatra, the second largest member (if New Guinea be excluded) of the East Indian Archipelago, sits astride the equator between 93° and 106° E. longitude, having on its east the Straits of Malacca and the Java Sea; and on its west the Mentawi abyss—15,000 feet deep—of the Indian Ocean. The island occupies the western cornice of the extensive submarine plateau, which, out as far as the Philippines, once formed part of the Asiatic mainland. Its conformation is striking. Along its western verge runs throughout its length a continuous, in some parts double, chain, the Barisan range, with summits reaching 12,000 to 13,000 feet—a range traceable northward through the Andamans, Nicobars, and Assam to the Himalaya spurs, and southward into Java.

Two orogenic factors are observable in Sumatra: that due to the enormous subsidence of the Asiatic continent responsible for the uplift of the Barisan, and that of the zones of fracture due to violent tectonic action which contributed to amplify the long depressions which furrow the length of the island. Atjeh and the Gayo lands form an ancient horst, 7000 feet high, of archæan rocks, cropping out of much-denuded Tertiary sediments. The Batak plateau (the southern part of this bastion) has been the centre of intense volcanic

outbursts. The oldest determined fossils are of Upper Carboniferous age. During the Mesozoic the island was, probably totally, submerged. In mid-Sumatra the fossil-bearing marly schists are ascribed to the Upper Cretaceous. The Ombilin coal-measures, in the Padang Highlands, are Eocene. The last uplift at the end of the Miocene was accompanied by renewed vulcanicity whose ejections overlies the previous formations, and have delineated the present morphology of Sumatra. South of 2° of south latitude, the sedimentary rocks are of late Tertiary age, at the close of which Sumatra became entirely insular. The gradual abatement of the terrestrial convulsions, which lasted far into the Quaternary, was attended by greatly increased precipitation, producing torrential rivers and intensified outflow of the lakes, whose action while softening the lineaments of the land created the vast alluvial plains which cover two-thirds of the coasts of Sumatra. Wonderful vistas are to be obtained from the mountain peaks, and landscapes of great beauty are met with throughout, especially in the highlands of the north and north central districts, where an alpine flora occurs.

The soil, a compact of humus and disintegrated lava, acted on by an abundant rainfall (an average of from 80 to 118 inches annually) with sea breezes modifying the equatorial heat, is extremely fertile. The island therefore throbs with life, and is clothed with a very dense and diverse mantle of vegetation. Biologically, it is in closer agreement with the Malay Peninsula and Borneo than with Java. Its immense virgin resources are however but little explored. Hundreds of plant species are still unknown to the botanist. Its great woods harbour noble arboreal giants of high economic value; they are rich in luscious fruits and contain some of the most striking and bizarre products of the vegetable world; their wealth in ferns, orchids, and aquatic plants in the river backwaters, is past reckoning. The fauna of Sumatra equals its flora in richness. The island is a paradise for the naturalist and sportsman. Tiger, leopard, elephant, rhinoceros, tapir, wild boar, mountain goat, and well-antlered deer are to be had without great searching. The flora and fauna of north Sumatra seem to differ from those south of the equator. The *Pinus Merkusii* (recalling the deodar of the Himalayas) is endemic to these highlands, while the orang-utan, the wild goat, and other species have not been met with in Southern Sumatra.

Historical and Economic.—Under "L'Ambiance," chapters are devoted to "L'Histoire"; "La Domination"; "L'Economie."

The indigenes of Sumatra have no traditions, and no pre-Hindu monuments. The Chinese and Arab adventurers were acquainted commercially with the island before it came to the knowledge of the western world, and that through the trade in almost one unattractive commodity—the pepper of everyday use. The keen competition for this spice instituted a cycle of great geographical discovery and commercial activities, in which the Portuguese, Dutch, and English in turn took part. Their rivalries are traced by M. Collet through the troublous centuries till the restoration of Java by the English, and later the exchange of Bencoolen for Malacca and the end of the forty years' war with Atjeh, at last brought Sumatra under almost complete Dutch dominion. Coincident with the hoisting of our flag at Batavia in 1811 a new Sultan of Palembang (between whose predecessors and the Dutch there had existed for 180 years a treaty of peace and commerce) suddenly inaugurated his defection by the massacre of the whole of the factory officials and the Javanese garrison. With regard to this deplorable incident M. Collet has not hesitated to bring the gravest allegations against Sir Stamford Raffles—whom he recognizes in

one passage as "le grand homme d'Etat Colonial." It is fair we should quote his own words: "Il ne saurait y avoir de doute sérieux à ce sujet, à la instigation des Anglais les Hollandais dans la ville furent massacrés" (p. 90), and again (p. 458): "Les incitations de Raffles . . . dont la politique donna souvent lieu à de suspicions, ne furent peut-être pas étrangers à l'affreux massacre dont tous les Européens de Palembang furent victimes le 14 septembre 1811." It ought to be noted that on that date four days only had elapsed since Raffles' landing in Batavia with Lord Minto. For these calumnies M. Collet ought in justice to have stated his authority. Sir Stamford's 'Life,' which is not even included in the author's bibliography, should have been sufficient, if he had ever read it, to prevent his publishing such an outrageous suggestion against so upright an administrator, whose friendship for the natives is a matter of history. As the present writer has elsewhere narrated, Raffles' memory was held in the warmest regard sixty years after his death by the descendants of the native officers who served under him.

Sumatra has now been brought almost entirely under Dutch domination. The key to their successful political supremacy, M. Collet claims, has been their scrupulous respect—only, it should be added, *after* the rendition by the English—for the beliefs and customs of the indigenes to whom it has brought widely distributed prosperity. Previously they lived at the mercy of the sultans and lesser rulers whose pleasure conditioned the law. Courts of Justice under European judges have been instituted; piracy, slave raiding, as well as domestic slavery, have been abolished. Schools, hospitals, compulsory vaccination, and schemes for their social progress have been widely inaugurated.

As soon as Holland abandoned her exclusiveness in the second half of the nineteenth century and threw open her Indian possessions to European colonization the economic prosperity of Sumatra began to advance with extraordinary rapidity, chiefly due to the establishment of plantations and the discovery of petroleum. In 1921 her total exports reached the figure of some 18½ millions sterling against imports of less than 13 millions. Minerals and petroleum produced 4 millions; plantations (rubber, coffee, tea, palm-oil—in which Sumatra now competes with West Africa), close on 3 millions; while quinine and tobacco figure at 6½ millions sterling.

Ethnological.—Under the heading of "Les Populations," the third section treats of "La Démographie"; "Les Hommes"; "Les Sociétés."

The first of these discusses the somatic and physiological characters and the psychological peculiarities of the indigenes and their diverse reactions to their environment—geographical and political. The mean distribution and density of the population, which is only fourteen to the square kilometre (owing to epidemics of malaria and small-pox, now diminishing through the influence of education and the establishment of hospitals), contrast unfavourably with the 266 to the same area in Java.

Racially the people, with the exception of the Atjehnese, the Gayos, and the islanders of the west coast, are Malays showing as a whole great uniformity of type. M. Collet analyses their peculiar psychology (leading to *amok* among the men and *latah* among the women); their family, social, and ceremonial life; their advanced architectural art; their literary abilities and their script.

The final chapter of this part considers the associations and tribal institutions of the indigenes; their totemism, transmigration ideas, fetishism, and phallic cults; organization of their clans; the result of the superposition of Islamic laws upon their pagan customs and creeds; and the changes in their

genealogical and terrestrial communities following upon the Government's assumption of sole ownership of the soil.

Regional.—The second sheaf of nine chapters treats of the Regions into which Sumatra is divided for administrative purposes. Each is reviewed in succession from north to south in its geological, ethnographical, racial, and geographical bearings and its relations to the dominant power. The entire section, running to 257 pages, can be reviewed only in the merest outline in the space at our disposal. It opens with a chapter on "La Forêt et les Sylvicoles," where administrative laws hardly run, peopled only by herds of savage animals and nomad hordes. Of the latter M. Collet gives us an account of (among others) the Koeboes, probably the most primitive of surviving tribes—a remarkable and arresting picture (to whose truth the present writer can testify) of a human community living amid countless enemies, with the forest shade their sole shelter and its natural products their only subsistence, yet holding their own from time immemorial in so low a state of existence as to have never discovered how to shape even the rudest stone as an implement or a weapon—a truly pre-palæolithic stage of humanity.

M. Collet begins his detailed survey with the *Government of Atjeh and its dependencies*; its coastal Radjahliks, and the Gayo and Alas peoples of its central horst, who, having lived isolated till the beginning of the twentieth century, preserving their language and institutions intact, offer a rich harvest to some fortunate anthropological explorer; he goes on to the *Tapanoeli Residency*, its capital, Sibolga, planted in one of the most beautiful and capacious harbours of Sumatra; and the proto-Malayan Bataks living around the immense Toba lake. An excellent account of these people was given by Baron v. Huegel in his review of Baron von Brenner's 'Besuch bei den Kannibalen von Sumatras' in the *Journal* for January and February 1896. Although M. Collet does not include the book in his bibliography, it is evident that this chapter owes much to von Brenner's observations. Under the *Government of the East Coast* the author passes in review its famous "Aire de Culture," whose prosperity is largely due to its tobacco plantations; then passing to the *West Coast Residency*, facing the Indian Ocean he gives a history of the Padang Highlands, the most densely populated and the most advanced region of the island, whose inhabitants are noted for their artistic architectural skill, their industrial efficiency, and the beauty of their women; and of the ancient kingdom of Menangkabau within the same province, whose ethnographical and ethnological story forms one of the most interesting of the book. Neighbour to it lies *Bencoolen*, a mere ribbon of land between the sea and the range, a colony of fisherfolk, but of special interest to Englishmen, because of Sir Stamford Raffles' Lieutenant-Governorship at Fort Marlborough, where he had lived in high hopes of its becoming the centre of extended British possessions in the Archipelago. Recrossing to the eastern coast, M. Collet devotes many pages to the important provinces of *Djambi* and *Palembang*, especially to the latter, and to the famous Royal Dutch Petroleum wells near Palembang, its capital, from which the province takes its name; to the town itself, one of the most picturesque and bizzare to be found anywhere, with the wide Moesi river for its main street, flowing between long lines of floating habitations, rising and falling with every tide. Finally, guiding us to the southernmost province of *Les Districts Lampong*, M. Collet tells us of its singular population with affinities to the Bataks; of the Lampongers' prodigious vanity for titles (pangkat) and decorations; of its rich pepper gardens, far eclipsing those of

Atjeh which were long supreme, and exporting, in 1919, 1½ millions' worth—an extraordinary sum considering the small amount of this spice annually consumed per individual in the world. Before quitting the province we may quote once again from our author for the delectation of the reader: "In the beginning of the 19th century this province knew a ruler—a sort of national hero now the subject of popular legends—whose achievements were only those of a brigand more fortunate than his rivals . . . the indefatigable Raffles . . .!"

The volume concludes with a lengthy historical and ethnographical account of the islands of the west coast archipelago, the chief of which are Nias, the Mentawi Group, Engano, and their satellites.

M. Collet's monograph is a very accurate and welcome contribution to our fuller knowledge of this most beautiful island of the Malay Archipelago, and one it would be difficult to outrival anywhere.

HENRY O. FORBES.

THE SURVEY OF INDIA IN THE GREAT WAR

Records of the Survey of India, Vol. XX.: The War Record, 1914-1920.

Dehra Dun: Survey of India. 1925. 10 × 6½, pp. xxv. + 155. *Illustrations and Five Maps in Pocket.* 5s. 3d.

THE survey problem during the Great War on the Western Front was mainly one of accurate mapping on a comparatively large scale within a limited area; of the constant revision of trench and other detail; and of printing and supplying large quantities of maps. The problem in the Eastern theatre, with which this volume deals, was in many ways less intensive, and more extensive. The scale of the maps produced was as a rule considerably smaller, as was the number of troops to be supplied; on the other hand, the area over which survey was carried was very much larger. Mesopotamia, Kurdistan, Macedonia, Arabia, Persia, Afghanistan, Palestine, East Africa—in all these areas detachments of officers of the Survey of India worked; and the mere recital of these names makes one realize the extent of our far-flung battle line.

The total area mapped on the half-inch or larger scales during the six years with which this record deals, was 180,000 square miles, or about twice the area of Great Britain. This was serious mapping, based on triangulation, and additional to very large areas which were reconnoitred or traversed. The total area of which more or less reliable geographical knowledge was obtained was comparable to that of Europe. This is a most remarkable achievement, and one of which the Survey of India has every reason to be proud.

The volume opens with a preface by the present Surveyor-General, Colonel Commandant E. A. Tandy; and after an introduction by the editor, includes three Parts, dealing respectively with Mesopotamia, Persia, and miscellaneous theatres.

In the Eastern theatre there was no distinct division between war and peace. Hardly had the war proper ended when the Kurdish rebellion broke out, then came the Arab rising, followed by the Afghan War. Hence the record covers the period 1914 to 1919, during most of which time a state of war existed.

The problem in Mesopotamia, dealt with in Part I., was the most serious and difficult with which the Survey had to deal. The Survey organization was from the first mainly under Colonel Pirrie, I.A., his small party of two Indian surveyors developing, after the capture of Baghdad, in 1917, into a Directorate including eighteen British and Indian officers and thirty-two other

ranks. In 1916 a Compilation Section, which was under the General Staff and independent of Colonel Pirrie's command, was organized by Major Gunter to deal with the mapping of forward areas, chiefly by means of air photographs. The work of this section was invaluable, and, as the Record says, it "laid the foundations of success."

Survey in Mesopotamia, and operations generally, were governed almost entirely by the physical fact of the two rivers, the sole lines of advance and retirement. Surveyors were not allowed to leave the river without escorts, which could not always be supplied. This led to serious difficulties on occasions, particularly when the army advanced to Kut. It was all-important that maps should be made of all the accessible country while this was possible, and Colonel Pirrie made every effort to do so. Unfortunately, the Army Commander was unable to provide the necessary escorts. The result was that, later, during the attempts to relieve Kut, no reliable maps were available; and for this the Survey of India was rather unfairly blamed.

After the Armistice survey work was pushed on energetically. There is a graphic account of the rapid reconnaissances carried out in Kurdistan by Major Mason and Khan Bahadur Sher Jang. These proved invaluable later when the Kurdish rebellion took place. A remarkable piece of work was also done by Captain Lewis, who in sixteen days carried a triangulation and $\frac{1}{4}$ -inch topographical sketch over 200 miles of country, connecting with the Egyptian work at Aleppo.

In Persia (Part II.) rapid surveys were carried out over large areas. Adventure of every kind was met. A characteristic British achievement was that of Captain Perry, attached to a mutinous Russian army, and carrying on his surveys with the aid of local escorts arranged by the British Consul at Kermanshah. At the other end of the scale comes Major Rich's enlistment at Tiflis of Russian ladies as "Draftsmen." In East Persia a party under Colonel Crosthwait carried out an extensive survey.

In Macedonia (Part III.) the survey problem was more on the lines of that in France, with a stabilized front line. In December 1916 Major Wood took charge, and reorganized the triangulation. Early in 1918 the 8th Field Survey Company was formed, with two Sound Ranging and one Flash Spotting Section. The rest of this Part deals with work in Palestine, East Africa, and the N.W. Frontier. The Record contains much other interesting matter to which it is impossible to refer here.

The editing has been done by Major Mason, and he has produced a most readable volume, lightened by touches of humour such as are too seldom found in official histories. As instances of this may be given the account (p. 13) of the delight of the British Army at the "discovery" of the cities of Sodom and Gomorrah, and (p. 81) the means adopted to ensure rapid progress among Major Rich's drawing staff. They were told that if they did not become efficient tracers in a week they would be dismissed. It is recorded that their progress was "marvellous": a result which may give food for thought to those who employ draftsmen at home.

Instances of gallantry and devotion to duty on the part of the Indian Surveyors are numerous. Particular mention must be made of the combined geographical and political mission of Khan Bahadur Sher Jang through Central Kurdistan, already briefly referred to above. This able officer, after a very difficult journey, during which he carried out a route survey, met the Kurdish Chief Sayyid Taha and succeeded in persuading him, after a night of argument, to come to the British Station at Ruwandiz.

At the beginning of the Record are photographs of the British officers of the Survey who lost their lives in the War, and personal notes on each are given at the end. The volume contains five maps in a pocket, and four sketch-maps in the text, as well as a number of illustrations from photographs. There are four appendices, a personal index, and a general index. The volume is well got up and the printing is excellent.

E. M. J.

DR. HUNTINGTON ON HUMAN GEOGRAPHY: REVIEW

The Pulse of Progress, including a Sketch of Jewish History.— Ellsworth Huntington. With a chapter on Climatic Changes by G. C. Simpson. London and New York: Charles Scribner's Sons. 1926. 9½ × 6, pp. xii. + 342. 21s.

IN this volume Dr. Huntington once more exhibits the diligence, originality, courage, and enthusiasm which have made his earlier works a delight to the general reader and a stinging stimulus to the critical faculties of the geographer. 'The Pulse of Progress' re-states many of the author's somewhat speculative hypotheses as to the changes in physical environment and their ecological influence, especially with regard to human history. It naturally bristles with points which challenge detailed criticism, but as far as possible we will try to avoid these by dealing with the wider aspects of the hypotheses used in the search for a geographical theory.

Three motives induced Dr. Huntington to write this book: (1) the demand for a clear and interesting popular statement of scientific conclusions in non-technical language; (2) the opinion that his views as to man and environment, originally elaborated in a dozen volumes, should be brought into the compass of one; and (3) the hope that a sketch in which account is taken of "recent advances in our knowledge of human geography, ethnography, economics, sociology, and biology" may prepare the way for a real history of human progress. He has certainly succeeded as to the first two points, and as to the third he has at least shown himself to be a serious man of science anxious to sift evidence and ready to modify his theories to fit new facts as they emerge. He is trying to break a way through a tangled forest, and he does not attempt to ride any hobby of his own rough-shod over other men's gardens.

The measurement of the breadth of the annual rings in the giant trees of California, some of which are 4000 years old, enabled Dr. Huntington, with certain assumptions, to construct a curve of climatic variation for a very long portion of the historic period. An instance of the response of vegetation to climate which is too recent for him to refer to leads us to place confidence in his results. This is the confirmation of the early meteorological records at Greenwich Observatory (which had long been suspected of inaccuracy) by the discovery of an old phenological record in Norfolk in which the seasonal curve of the blooming of plants in the early part of the nineteenth century exactly reproduced the variations of the Greenwich thermometer which had seemed too erratic to be true.* It is also recognized as a definite result of recent meteorological research that the weather in widely separated parts of the world shows a distinct though not always a direct mutual relationship.

* Note by Dr. Simpson on I. D. Margary's "Marsham Phenological Record." *Q.J.R. Met. Soc.*, 52 (1926), p. 52.

We fear, however, that Dr. Huntington's claim that the Mediterranean area has experienced changes similar to and synchronous with those of California will be hard to prove. He is wise enough not to press unduly the possibility of changes in Californian climate giving a date to prehistoric events in the ancient world, and the fact that the chapter on Climatic Changes is contributed by so orthodox and cautious a meteorologist as Dr. G. C. Simpson shows that Dr. Huntington prefers a balanced judgment to a partisan statement of the views he would like to see confirmed.

The purpose of the book is to give a clear statement of the action of environment on the temperament of individuals in particular and on the inherited and acquired character of races in general. Taking the broad ground that human nature is now as it was in the beginning of history, the author studies the influence of environment on temperamental types in the United States on the basis of the immensely detailed Census figures for classes of people and the much looser data contained in 'Who's Who in America' for individuals. The result is a fascinating picture of modern migration within the United States, showing how people of different temperaments, as indicated by their occupations or recreations, are sorted out and regrouped in other settings. The handicap of poor land is strikingly demonstrated by statistics which suggest that however much at random the population is thrown on the land, after a few years the better farmers come into possession of the best lands and the poorer lands come inevitably into the occupation of the worst farmers. The contrast between the sedentary agriculturist and the wandering nomad is adumbrated in the American statistics and admirably set forth by reference to the people of the desert margins studied by Dr. Huntington in the Old World. While poor farm land stunts the development of the farmer whose character is weak enough to allow him to remain on it, the austerity of desert conditions stimulates and disciplines the nomad who has the pluck to endure it, and kills off the rest.

The sifting power of cities is treated with remarkable effect. The author shows how temperament rather than race is the cause of the assembling of the various classes of the population in villages, towns, and cities as well as in countries. Cities are viewed as tools by which civilization is advanced, the more enterprising, the more cultured, and the more fastidious people being drawn in from country districts with a force increasing as the city grows; but the lower birth-rate and the higher death-rate of cities make constant recruitment from outside a condition of stability.

Nearly one-third of the work is devoted to a study of the origin, development and dispersal of the Jewish people. In this the author treats the Biblical narrative as history interpreted by ordinary historical methods, and this is certainly the most interesting part of the book, applying as it does the principles elaborated in the earlier chapters to a particular case which is not only the best-known but the most remarkable instance of the survival of a race moulded by the environment of a region which it occupied for a relatively short period. Perhaps the best chapter in the book is the fourteenth, entitled "The Isolation of Judea," in which a method of study familiar to British readers from the writings of such geographically minded Biblical scholars as the late Dr. William Miller of Madras and Sir George Adam Smith (neither of whom, by the way, is referred to) is used anew in an impressive manner.

While few geographers are likely to accept Dr. Huntington's theories in full as they are set forth, all must agree that they form a fine framework on which to display the facts and relationships dealt with in Geography with a

coherence that cannot fail to attract and instruct the general reader, while the specialist will find himself put on his mettle to furnish a better system of his science.

There is a full and serviceable index.

HUGH ROBERT MILL.

REVIEWS

EUROPE

Agricola's Road into Scotland.— Jessie Mothersole. London: John Lane. 1927. $7\frac{1}{2} \times 5$, pp. xxiv. + 260. *Map and Illustrations*. 10s. 6d. net.

ONCE more we are indebted to Miss Mothersole for a pleasant archaeological and topographical book. . Actually traversing the route on foot or on bicycle, she has described the course of Dere Street (called Leeming Lane in its southern stretch) from York to Newstead on Tweed. She has a sound instinct for the essentials in archæology, and a light human touch in description; moreover, her pictures with brush and pen are in the best sense illustrative. Here we have six coloured plates, seventeen in black and white, fifty sketches and plans in the text, and an adequate map of the general line of the Roman road. At the end is a useful table giving the Roman sites on the road, the legions and auxiliaries who held them, the dates of excavation, English mileage between them, and other information. The general reader with a taste for archæology will certainly enjoy a perusal of her pages, and will be equipped against the day when he can follow her steps and enjoy the mild adventures of following a Roman road for some 140 miles. With imperturbable good temper she takes her vicissitudes of wet and dry, rough and smooth, open and fenced: "Roman roads," as she writes, "have an embarrassing way of leading one on to private property, and even in at back gates." *En route* there is much that is interesting and suggestive. Thus Leeming Lane, which coincides with Dere Street, has a run of 13 miles without a single village on it—a rare phenomenon in England. No fewer than eight forts and camps on the line are still awaiting modern excavation methods: when will the money and the men enable us to do our duty by our national history? Miss Mothersole gives some capital short sketches of the results of excavation, *e.g.* at Binchester, Gorbridge, and Newstead, and she has laid under contribution all the specialists of note from MacLauchlan to Curle. Of course, she has the usual tale to tell of pitiful and wanton destruction of inscribed stones in the seventeenth century, *e.g.* at Lanchester; and she has well realized "how unsafe it is to trust even the most plausible conjecture as to the exact line of the road." In the spade alone is safety. The most thrilling part of the journey is north from High Rochester, with the road reaching 1674 feet in its crossing of the Cheviots, with the fine Makendon Camps at Chew Green, and Newstead camps and fort for a finish. A few minor suggestions may be permitted. The plates, as well as the figures, should be numbered. Inscription on p. 24: there is no Greek W, though omega somewhat resembles that letter. The "Samian" potter on p. 34 is not VXTVLLI, but MVXTVLLI·M, as at Colchester and Wroxeter (a Lezoux potter of the second half of the second century). "The Tofts," p. 45: the name is probably significant; a toft is a site of an old building marked by ruins. The line of Dere Street should be indicated in relation to Trimontium (p. 237).

S. E. W.

The High Peak to Sherwood.— T. L. Tudor. London: Robert Scott. 1926. 7½ × 5, pp. x. + 398. *Illustrations.* 7s. 6d. net.

This is a book of unusual interest and deals in a very thorough and attractive manner with one of the most remarkable districts in England. The area described is not confined to one county, yet it is Derbyshire which, owing to the special characteristics of its scenery and to its remarkable geographical position, comes in for the most detailed attention. It reminds us that long before the formation of any such territorial divisions as shires the central portion of England now known as Derbyshire, together with east Staffordshire and west Nottinghamshire, really formed a roughly defined unity—the nucleus of the ancient realm of Mercia. In the seventh century this consisted mainly of the district enclosed between the Humber, the Trent, and the Welsh Marches, together with a loosely defined area south of the Trent. It was these regions—for the most part wild and rocky, and largely covered with dense forests—that so greatly aggravated the task of pacification and settlement, and the same natural characteristics largely account for the measure of wildness and solitude which even to-day in this “Switzerland of England” offer such a vivid contrast to the deplorable progress of “uglification” in modern England. In no other county than Derbyshire, perhaps, have the natural features so conduced to the intermarriage of the leading county families, who, prior to the day of the railway, almost formed one great clan that stretched from the Staffordshire border near Dovedale on the west, across the whole county to the confines of Nottinghamshire on the east. Moreover, there is ground for believing, with the late Lord Curzon, that the purest form of English pronunciation is that found among the educated classes of this secluded hill country in the heart of old Mercia. The geographical conditions of the Peak country, and especially its remoteness from the east and south coasts, have resisted, or at any rate diluted, foreign influences so that the characteristics tend to be quite noticeably local. And it is here that we may naturally look for definitely English, as distinct from Saxon, origins.

The term “High Peak” is by no means, as is commonly supposed, of modern origin. It came into use at least as early as the end of the thirteenth century, and it is found, under the form “Alto Pecco,” in documents of the fourteenth century and onwards. Interesting notices will be found in this book of the varied mineral products of the Peak district—the coalfields in the north and east of Derbyshire, the Blue-John mines of Castleton, the lead mines of Wirksworth, and the alabaster quarries of Chellaston, which contributed the material for some of the beautiful work in the Garter Chapel at St. George’s, Windsor. In prehistoric remains of various types Derbyshire is one of the richest counties in England. One of the most interesting districts is that of Castleton, and here is celebrated, on May 29 (though clearly of much earlier origin than Stuart times), the famous ritual Folk Dance Festival known as “Garland Day.” At Tissington, the home of the Fitzherberts, the Ascension Day celebration of the “Well Dressing” of the five springs of living water round the village green is the most famous festival of its kind in England. Its origin takes us back to very early pagan times, and may have been a legacy from the Roman occupation. An excellent detailed account of this will be found here.

It is doubtless due to an oversight that no mention is made of what is probably the most ancient form of football known. It has been specially in vogue in the ancient towns of Derby and Ashbourne since times immemorial, and is always primarily associated with Shrove Tuesday. In the county town

itself it has become impracticable, but at Ashbourne there are as yet no insuperable barriers to the time-honoured institution, which—so an ancient legend tells us—owes its origin to the rejoicings for a victory over Danish invaders, one of whom, having lost his head, thereby provided the object with which the sport was so wholeheartedly enjoyed.

The sketch-map (p. xi.) is unfortunately small and inadequate, and gives no county boundaries, but there are many charming illustrations, the delightful little sketches in the text being often of real beauty. Lastly, much light is thrown on the significance of the place-names of the Peak region, so many of which are of geographical import and of extremely ancient origin.

W. W.

Leeds : Old and New.— Percy Robinson, F.R.I.B.A. Leeds : Richard Jackson, Ltd. 1926. 9 × 6, pp. xvi. + 151. 7s. 6d. net.

Leeds and its History.— Leeds : The Yorkshire Post. 1926. 8½ × 5½, pp. 192. 2s. net.

In July 1926 the City of Leeds celebrated the three hundredth anniversary of its existence as a municipal borough, with celebrations which were directly responsible for the preparation of the second of these volumes and gave favourable conditions for the other.

The scope of Mr. Robinson's work is stated in its sub-title, "A Picturesque Sketch of the History of the City. . . ." It gives a vivid outline account of the growth of Leeds; but its main interest is in its studies of architectural features, particularly of the domestic architecture of the last three centuries. It is illustrated by thirty-one reproductions of drawings by the author, many of which are of buildings since demolished or so altered as to be almost unrecognizable. It would add to its value if each of these illustrations could be dated precisely; as it is we are only told in the preface that many of them were drawn more than thirty years ago.

The second volume is a reprint of the more important articles contributed to the Tercentenary Supplement of the *Yorkshire Post*, under less exiguous conditions as to space. "The Story of Leeds" is briefly and clearly set out by Professor A. Hamilton Thompson. Mr. A. N. Shimmmin writes of "The Ninety-Seven Industries"; and Sir John Eaglesome contributes a section on "The Waterways." Mr. J. C. Gregory and Dr. H. Thompson are responsible for articles on "Science" and "Music" respectively, and the rest of the book is written by unnamed members of the staff of the paper. Probably the sections of widest general interest are the four on History, Industries, Transport, and Town Planning. The first of these sketches the growth of a village to a manorial borough (which, in spite of its advantages of location, was of merely local importance before the Industrial Age), and to a large modern industrial city. The Labour Exchanges classify the insured workers of Leeds under ninety-seven industries, a good indication of the variety of its industrial enterprises; and it will probably surprise many citizens of Leeds as well as others to learn that the woollen and worsted industry ranks only fourth among these, as measured by the number of insured workers. Six principal occupations account for two-thirds of the industrial population, namely, Tailoring (30),* Distributive Trades (18), General Engineering (15), Woollen and Worsted (8), Building (7), Printing and Bookbinding (6), and there are twenty-five others with more than a thousand workers each. The figures are for 1925-6, in which year engineering was very depressed. When in full work that industry

* Figures in brackets show number of insured workers in thousands.

ranks second in numbers and probably first in value of capital employed and goods produced.

The high position of the Distributive Trades is a result, and to some extent a measure, of the importance of the city as a commercial centre and regional focus for a large part of Yorkshire. The articles on Transport describe the development of means of transport during the Industrial Age from the pack-horse to the motor lorry. The chief waterway, the Aire and Calder Navigation, is one of the few in England which still pay their way. It makes Leeds accessible to small coasting vessels and regularly runs barges of 100 tons capacity; many people look forward to its development into a Ship Canal. Such a development may be essential to the continuance of the growth of Leeds, and the obstacles in the way are financial and political rather than physical. In Town Planning the City Council, working through an energetic Improvements Committee, has during the last fifty years made steady progress in clearing slums, widening streets, making roads, and in other ways amending the city. Leeds grew very rapidly in the early part of our Industrial Era, its population trebled between 1801 and 1841, and the legacy of overcrowded and unplanned building of that period still weighs heavy on the city, though its citizens have reason to be proud of what has been accomplished.

These books are of real value as contributions towards our knowledge of a fairly typical industrial city. Mr. Robinson's volume is well printed and got up, and its illustrations alone make it good value for its price. The second volume is in smaller type and paper covers, and has no index. The reader who wishes to get the best from either will need to supplement the illustrations by an adequate map.

C. B. F.

E. V. Lucas's London. London: Methuen & Co. 1926. 9 × 5½, pp. xii. + 431. *Coloured Plates and Illustrations.* 20s. *net.*

This volume consists of Mr. Lucas's two well-known books on London—'A Wanderer in London' and 'London Revisited'—with some additional matter. In this form it is suited rather for reference than to be a companion for the rambler: one is never quite sure where one will be conducted next, either in time or space. An example may be taken from the illustrations: it is a little surprising at first to find the "Bush Building" followed by the "Avenue at Middleharnis," but that is all part of the entertainment, and Mr. Lucas is certainly a successful showman. Is it permissible to ask, however, whether it is altogether appropriate in such a book to give quite so much space to the *interior* of museums and art galleries?

Unknown Hampshire.— Clive Holland. Illustrated by Douglas Snowdon. London: John Lane. 1926. 9 × 7½, pp. xv. + 260. 15s. *net.*

It is perhaps rather late in the day to comment upon the title of this series: yet if one were to inquire what were the best-known parts of Hampshire, one would probably be told Bournemouth, the New Forest, Winchester, and Southampton, so that it is not very stimulating to find that the first chapter here deals with the outlines of the history and topography of the Forest, and that later chapters are devoted to the other centres mentioned. This is not to say that the picturesque hamlets and byways are entirely neglected, but more space could have been given to them profitably, for the author realizes their charm and at times describes natural beauties with feeling. His frequent remarks upon the presence of motor coaches and tourists—not to use a less dignified name—form in themselves a commentary upon his title. He hardly does justice to the perhaps less well known Romsey Abbey, the architectural

interest of which he hurries over, while the greater part of its history he seems to have derived from another book in a well-known series.

Coal and the Coalfields in Wales.— F. J. North. Cardiff: National Museum of Wales; London: Humphrey Milford. 1926. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii. + 175. *Thirteen Plates, Thirty-two Figures.* 1s.

The modest form, and the still more modest price, of this paper-covered volume would scarcely lead one to suspect the wide scope and informative nature of its contents. In the words of the preface, the object of the memoir is "to provide, in language intelligible to those who have no special knowledge of geology and kindred branches of science, an account of the present state of our knowledge concerning the nature and origin of coal, and its distribution in the Principality." Too often the preparation of a popular museum handbook of this character is entrusted to authors characterized by their enthusiasm rather than by an intimate knowledge of their subject. In the present instance, however, Dr. North has not only been connected with the National Museum of Wales for thirteen years and is head of the Department of Geology, but is also a geologist who has achieved a reputation by the thoroughness characterizing his work. That thoroughness is a marked feature of the book under review. The first half is devoted to coal in general—its constitution, mode of occurrence, and mode of formation. Agreement has not yet been reached on questions relating to the constitution of coal, and it would be difficult to find a more adequate summary of the present state of knowledge—including the now well-known conclusions of Stopes and Wheeler, as well as the results obtained by Seyler as recently as 1926. Again, in the section on mode of formation, there is a clear exposition of the principles of geology involved. But lengthy quotations from Lyell's writings of a century ago have not prevented Dr. North from including a discussion of the bearing of Wegener's hypothesis on the vexed question of the climate of Coal-measure times studied as recently as 1926 by C. E. P. Brooks. The coalfields of Wales, in the second half, are described in equally lucid language and a bibliography of 309 items concludes the whole. Thirteen plates, one of them in colour, and a number of excellent diagrams illustrate the text. The author is to be congratulated on the production of a model museum handbook, which is, in addition, an original work deserving of attention from all interested in the geography and natural resources of Wales.

L. D. S.

Amid the Forests of Normandy.— Edouard Herriot. Translated by J. H. Lepper. London: Cassell & Co., Ltd. 1926. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 275. *Illustrated.* 10s. 6d. net.

M. Herriot's eulogy of Normandy, its countryside and its people, doubtless read more easily in the original French than in this translation, though perhaps Mr. Lepper has striven consciously to retain the Gaelic flavour. The style is certainly vigorous and picturesque, in keeping with the subject. Despite its title the book is mainly historical: two long sections are devoted to Monsieur de Rancé, the restless seventeenth-century ecclesiastic, and Charlotte de Corday, the "Norman Judith." The monuments of the province are also given a prominent place, and are the theme of most of the illustrations. The needs of the tourist are, however, not altogether neglected.

Les Préalpes de Savoie (Genevois, Bauges) et leur Avant-Pays.— Étude de Géographie Régionale, par André Cholley. Paris: Armand Colin. 1925. $9\frac{1}{2} \times 7\frac{1}{2}$, pp. iii. + 756. *Eighty Text Figures, six Plates.* Broché 55 fr.

To criticize adequately a book such as this presupposes a very considerable knowledge of local detail. For a similar reason the book is not likely to make

a very wide appeal to geographers in general. But this must not be understood in any depreciatory sense. A work of this type and of the dimensions of this particular volume naturally means a great deal of field work and diligent researches into archives and other sources of information. In its present form the book offers a very complete account of the geography—in the widest sense of the word—of the pre-Alps of Savoy, though the ordinary reader will miss two important requisites of any such work: a good index and a tolerably complete and large-scale map of the area. Unfortunately both are absent.

The matters dealt with cover a very wide range. The volume consists of four parts: the first deals with the structure and physiography of the area in considerable detail; the second with the climate and hydrography; the third with man and natural conditions; and the fourth with types of life. The area described is bounded, roughly, on the north by the Arve downstream from Cluses to the Swiss frontier; on the west by the Rhône and the Montagnes de l'Épine; on the south by the Chartreuse; and on the east by the valleys of the Isère and Arly. Perhaps the most important features of this region are the three great transverse depressions of the Arve, Annecy and Chambéry-Bourget. Physiographically these valleys owe their formation in part to fluvial erosion in Pliocene times, largely guided by the geological structure. During the Ice Age they suffered considerable modifications: deepening and widening. On the other hand, the secondary valleys owe little to ice-work, and their forms are due mainly to water erosion. Apart from their physiological interest, the valleys are of the utmost importance in the economic and human development of the area. Further, they offer interesting climatic problems.

In many respects the morphology of the area is of the Jura mountain type: "on y retrouve les voûtes et les plateaux calcaires, les vaux et les combes, les cluses de Jura, et le même paysage d'escarpements et d'éboulis." In the pre-Alps, however, the Urgonian is the main structural element. Further, the tectonic structures are more complicated than those characteristic of the Jura. The ridges are nearly all strongly asymmetrical—the western slopes being very steep. Other differences from the Jura are due to a more complex hydrographical system and to the influence of the main Alpine glaciers.

In a short review it is impossible to analyze each section of the volume. Suffice it to say that the whole bears the impress of careful and skilled work. From the point of view of readers not acquainted, or only slightly acquainted, with Savoy, it is perhaps a pity that the author has not made more complete summaries of each part. Its large size and the comparative difficulty of finding one's way about the book render it particularly unsuitable for any but specialists. Furthermore, the text figures and sketch-maps are not all so clear as could be wished.

Nevertheless these minor points ought not to mask the fact that it is a scholarly work and one that all interested in detailed regional studies may consult with profit.

J. A. S.

Le Royaume Serbe Croate Slovène.— Albert Mousset. Préface de M. Albert Thomas. Paris: Bossard. 1926. 9 × 6, pp. 270. *Illustrations.*

In 1921 M. Albert Mousset published a book giving a general account of the Serb-Croat-Slovene kingdom, including a section on economics. That this book filled a place in current literature is shown by the fact that the present re-issue is described as the twelfth edition. It has now, however, been completely recast, and in particular the whole of the section dealing

with the social and economic life of the new kingdom has been relegated to a separate volume, now in the press. The present book deals, in brief and summary fashion, with the geographical situation and territorial organization, gives a somewhat fuller account of the constitution and administration, and goes on to discuss in some detail the thorny and complicated subject of internal politics and the aims of the various political parties. The separate elements of the population are then considered, together with the religious groupings. After a brief summary of external politics in relation to the different states of Europe, we have sections on the Press, Education, the Theatre, and the Arts. This summary will show that the book is not primarily geographical in aim, though it contains a good deal of raw material of which the geographer can make use. There is no map, but a number of striking illustrations are included. There is also an index of proper names. M. I. N.

Encyclopädie der Erdkunde.— Teil: Nordeuropa, bearbeitet von Univ.-Prof. Dr. Gustav Braun. Leipzig u. Wien: Franz Deuticke. 1926. 10 × 7, pp. 212. *Thirty-five Maps.* G.M.10.

This book opens with a useful summary of the contributions of workers in distant fields to the formation of a fairly complete cartographical survey of Northern Europe. The more general literature of the subject has also been passed in review, and a complete list of special works heads each section.

The second part deals briefly with the physical features of the region as determined by its underlying geological structure. An excellent sketch-map, with explanatory text, brings out clearly the relationship between the original Baltic shield, the stratified rocks still almost encircling it, and the confused mass of the great Caledonian thrust which, on the west, partly overlies both. The striking features of the Quaternary scene-changes are then described, as preparing the way for the present distribution of land and sea in their strongly individualized geographical setting.

A third section, with its accompanying map, gives categorically the natural divisions of the region; then follows section 4—occupying nearly five-sixths of the book—and giving a detailed description of each area. Here the writer really comes into his own. The outstanding features of each division are dwelt upon with precision, one would almost say from personal observation, were that possible in an area so wide. The age-long interaction between environment and humanity and, in each type of settlement, the evolutionary tendencies controlling choice of site and historical development are faithfully recorded.

A final section points out which features, individual to the region, set it from the rest of the world apart. Had this section preceded the one just mentioned, some repetition were possibly avoided.

For the specialist the book is a mine wherein to delve, but it hardly attains its real object, which is, presumably, to form in the mind a well-balanced picture of the region. For this purpose the second section is too general and the third too particular, so that the earnest student risks being stunned with facts before his grasp of the region as a whole is secure.

Illustrations, too, are seriously lacking: the reduced large-scale sectional maps do not supply this need. Sketches of the scenic types, as vivid and convincing as the descriptions, would have added greatly to the value of the work.

E. G. W.

ASIA

A Brief Outline of the Campaign in Mesopotamia, 1914-1918.— Major R. Evans. London: Sifton, Praed & Co. 1926. 9 × 5½, pp. 135. *Appendices and Four Maps.* 7s. 6d. net.

Many books, and several good ones, have already been written on the campaign in Mesopotamia, but the military student who confines his studies to this one will miss nothing. Though it purports to sketch but the outline of the subject, the various aspects of the campaign, political, strategical, tactical, and administrative, are dealt with in a really masterly way. The author has marshalled all the relevant facts and details of the operations without losing sight of the broader issues and factors affecting the higher conduct of the campaign. He rightly brings out the interdependence of policy and strategy, a lesson also vividly brought home by Sir William Robertson's well-known book. Above all, the merit of this work lies, not only in the accuracy of its detail, but in the frank, fair, and authoritative criticism which it delivers in respect to each of the major phases of the operations, and of the responsible commanders and political advisers. Written by a soldier for soldiers, the causes of success and failure are analyzed in a decided and effective manner, and one may safely advise every student of the art of war to add this excellent little book to his library.

J. W. M. C.

Mirabilia Descripta—Les Merveilles de l'Asie, par le Père Jourdain Catalani de Sévérac.— Henri Cordier, Membre de l'Institut, etc. Paris: Paul Geuthner. 1925. 11 × 9, pp. 125. *Plates I.-XIX.* 125 francs.

The spread of the Mongol conquests across Northern Asia as far as the Dnieper in Europe, followed by the overthrow of the great Muhammadan dynasty of the Abbasids by Hulagu Khan in 1258, and the religious tolerance displayed by the Mongol rulers, led to that stream of travellers to Asia in the thirteenth and fourteenth centuries, who lifted the veil that had so long covered the greater part of that continent. Many of these were emissaries of the Church, mainly Franciscans, but to this group belongs also the French Dominican monk Friar Jourdain Catalani de Sévérac, whose 'Mirabilia Descripta' contains not only interesting details regarding Armenia and Persia, but also the best account of India that has come down to us from so early a period. Of this work there is only one manuscript extant. Baron Coquebert de Montbret published a transcription of it for the Société de Géographie in 1839. Sir H. Yule translated this into English for the Hakluyt Society in 1863, with notes which he admitted were incomplete; but he did not examine the original MS., which was then in the British Museum. Yule amended and amplified his notes in his 'Cathay and the Way Thither' (second edn., 3, 39-44). His old friend and collaborator, the learned H. Cordier, completed this new edition in September 1924, only a few months before his death. Besides an historical introduction, a French translation, and a facsimile reproduction of the Latin MS., Cordier, while incorporating several of Yule's notes, added many notes of his own, clearing up doubtful points and inserting a mass of useful references that bring the work up to date. Had the task been accomplished in his full vigour he would doubtless have brought it to greater perfection. The absence is felt of a map showing all the places named by Jourdain, as also the need for more careful revision of the Latin text to make it agree more accurately with the MS. De Montbret's transcription has been revised in several places, but much remains to be done in this respect. A few examples must suffice. *Nibibus*, on p. 109, should read *nubibus*, as in the MS. *Aniba*, on p. 110,

which has been reproduced in this form in both the English and French translations, is *amba* in the MS., and this is the correct transliteration of the Persian word for the mango. *Sylem* (p. 119) and *abundat* (*ib.*) should read *Sylen* and *habundat*, respectively; and so on. Mohelar, again, in the French translation (p. 84, l. 14)—Yule's Mohebar—should read Mohabar, as it clearly is in the MS. For convenience of comparison between the three texts, the addition of paragraph numbers in the margins would have been of much assistance.

Unfortunately we receive little or no further light upon the personal history of Jourdain or the chronology of his travels. The only definite dates recorded by him are those contained in his letter of 20 October 1321, from Gogha on the east coast of Kathiawar, and in his letter of 20 January 1323 (? 1324) from Thana near Bombay. Curiously, both Yule and Cordier say that from this latter letter we learn that Jourdain had started from Tabriz to go to Cathay, but had been driven by a storm to land at Thana. The letter as printed in Latin does not, however, bear this out. There are reasons for believing that he was in Persia and India from 1320 to about 1328; but we do not know when he actually returned to Europe. From certain bulls of Pope John XXII. of different dates in 1329 and 1330 reproduced by Mgr. Mercati from the Vatican registers, it is clear that Jourdain was in Europe in 1329, and that he did not leave Avignon before April 1330, to take up the new bishopric of Quilon to which he had been appointed. After that we lose sight of him altogether, except for a story believed by some authors that he suffered martyrdom at Thana in or about the year 1336. We do not even know when he wrote his 'Mirabilia,' though both Yule and Cordier hold that it must have been before leaving Europe to assume his episcopal functions. If so, it would seem that he must have visited Quilon after his letter was despatched from Thana: but the question is not free from doubt. C. E. A. W. O.

The Ao Nagas.—J. P. Mills, M.A., I.C.S. Published by direction of the Government of Assam. London: Macmillan & Co. 1926. 8½ × 5½, pp. xviii. + 500. *Two Maps and Illustrations.* 30s. net.

The Government of Assam are to be congratulated on the fruit of the wise policy inaugurated by Sir B. Fuller in 1903 of promoting the preparation by competent writers of monographs on the more important tribes of that province, so rich in ethnological interest. Commencing in 1907 with Col. Gurdon's admirable work on the Khasis, a number of valuable accounts have now been issued of different tribes, forming a reliable basis for comparative ethnological study. This is the second monograph prepared by Mr. Mills, whose important account of the *Lhota Nagas* appeared in 1922. The present work deals with their neighbours on the north-east, the *Ao Nagas*, and supplies a mass of information, collected by methodical inquiry carried out in a scholarly manner, about their domestic life, religion and ceremonial practices, language, folk-tales and songs, supplemented by useful notes by Dr. Hutton.

There are some curious errors in the first note on p. 1. Ptolemy wrote in the first half of the second (not in the third or fourth) century A.D.; and there was no such language as Urdu in his time. Shihab-ud-din Talish wrote his account of Assam in the latter half of the seventeenth (not sixteenth) century. The question of the meaning of the name Naga was dealt with by Col. Waddell in *J.A.S.B.*, Pt. III., 1900, p. 62. Ptolemy's *Naggalogai* (see Renou's Greek text) probably represents *nagaloka* ("hill people"), though *nanga* (Sans. *nagna*), "naked," is also sometimes applied to such scantily clad folk of the jungle, as it is to nude ascetics. Several meanings of the word *nāga*, moreover, such as a large snake or serpent, a race of monstrous men, a name of various

plants, are probably all derivable from the root word *naga* (hill), hilly country being their traditional habitat. Enhanced value would have attached to many references to trees and plants, and their special uses, had the botanical names been added for correct identification.

This work, with its maps, illustrations, complete bibliography of the Naga Hills and exhaustive index, is nevertheless a model of what such monographs should be; and we wish the example of the Assam Department of Ethnography had been followed in other parts of India, where tribes and peoples of analogous interest still survive, and call for more detailed and scientific treatment than they have hitherto been accorded.

C. E. A. W. O.

History of Siam.— W. A. R. Wood, C.I.E. London: T. Fisher Unwin, Ltd. 1926. 9 × 6, pp. 294. 15s. *net*.

This is a most welcome volume to all who are interested in the East. For the first time we have a connected and authoritative account of an interesting people and wonderful country, the sole survivor of the dozen kingdoms existing in South-East Asia a hundred years ago—a fact of which its people may well be proud.

The destruction of all early records in the sack of the capital of Ayut'ia by the Burmese in 1767, and the inaccuracy of eighteenth-century compilations, has made the task no easy one, in spite of the researches of that scholarly member of the Royal Family, Prince Damrong; though some light is thrown on the history from the sixteenth century onwards by the accounts of European travellers like Pinto, Floris, and Van Vliet.

It is, as usual, a history of kings, of those who succumbed and of the others who ruled in their stead. In Siam the losing monarch often suffers extinction, in the peculiar manner reserved for those whom no plebeian hand may touch, by being enclosed in a velvet sack and clubbed to death.

The Tai race, from which the Siamese and the inhabitants of the Shan States in Burma derive their origin, come from hardy northern stock. Driven from their home in Nanchao (Yunnan) in China by the Tartar Kublai Khan, in 1253, they found their way southwards. They were already a highly civilized community with a regular administration, a fact admitted in respect of these "Barbarians" even by Chinese writers.

Thus driven forth they spread gradually west and south. In 1275 arose King Ramk'amheng, who prepared the way for the founding of the State of Siam seventy-five years later, with its capital at Ayut'ia. Ramk'amheng was a man of original ideas and great energy. He twice made a journey to China; in 1294 in order to see the aged chieftain Kublai Khan, and again in 1300—no mean pilgrimage to make even once in those days. As Mr. Wood says, we can only wish he had left us a diary giving his experiences, as the Chinese ambassador from Kublai Khan to Cambodia did in 1296.

In 1350, in a somewhat obscure way, a Prince of the neighbouring state of Chiengmai [Zimme] rose to power, became ruler of Siam, and founded the city of Ayut'ia [Ajodhya]. On succeeding as King of Siam he took the title of Rama T'ibodi [Ramadhipati]. He was remarkable for his legislative enactments.

Of other kings of note we may mention Boroma Trailoknat (1448–1488), who introduced many administrative changes of importance. One of these, known as the rule of *Sadki Na*, actually remained in force until modern times, being abolished by King Rama V. (1868–1910). By this rule the rank of every man in the kingdom was determined by the amount of land he was allowed to

possess, which varied from 4000 acres for a prince to 10 for a peasant. This king is also responsible for the "Palace Law," which is still nominally in force. Its rules were somewhat severe, as we find, for instance: "For shaking the King's boat—death"; "for kicking the palace door—the offender's foot to be cut off."

In 1509 Albuquerque came to Malacca, which Sequeira had visited a year earlier. This opens a new chapter in Siamese history. Albuquerque, hearing that Malacca was a dependence of Siam, sent Fernandez Duarte to Ayut'ia with a letter to the King, Rama T'ibodi II. (1491-1529). On this opening up of communication with the nations of Europe King Rama T'ibodi initiated the wise and tolerant policy towards foreigners which has ever since distinguished Siam. In 1612 the English arrived on the scene, the *Globe*, a British ship, anchoring in Patani harbour on June 23, and passing on to Ayut'ia in August. On board was the merchant William Floris, who has left us an account of his experiences.

From this time on English, Dutch, and Japanese are added to the Portuguese as commercial rivals. In 1675 the British ship *Phoenix* brought to Siam the Greek adventurer Constantine Phaulkon, who rose to be chief minister of the country. Europeans poured into the country, and embassies from Siam to France and from France to Siam took place, Louis XIV. sending to Phaulkon the Order of St. Michael and St. Peter in 1687.

There is not space to linger over details here, but a reference must be made to the capture of Ayut'ia by the Burmese. Twice was this town subjected to the violence of the Burmese: first in 1569, when Bhureng Naun sacked it and carried away the Royal Family captive; and again in 1767, when the Burmese King Alaungpaya's forces destroyed the city so effectually that it has remained a heap of ruins ever since, a new capital being started by King Taksin (1767-1782) at Bangkok.

Excellent as it is this is mainly a "Book of Kings"; indeed, it could not, probably, have been anything else without becoming too large. But may we hope that Mr. Wood or Prince Damrong, or both in collaboration, will give us a "Book of the People," dealing with their daily life, customs, and religion through the ages, especially religion, which in the East enfolds the others?

The book is well printed and illustrated. There are a few not very important slips: thus on page 35 Kublai Khan is said to have destroyed Nanchao in 1253, and on page 52 in 1254; King Leotai is said on page 59 to have died in 1347 and on page 65 in 1354; and a slip of 1846 for 1546 is made in the note on page 106. In a second edition certain additions might be made with advantage. A list of kings with dates showing contemporary rulers of Siam, Chiengmai, Cambodia, and Burma would be useful; a list of authorities is essential; the map might be clearer; and last, but not least, the index should be fuller.

C. E. L.

Things Chinese.— J. D. Ball. 5th edition, revised by E. Chalmers Werner. London: John Murray. 1926. 9 × 6, pp. 766. 24s. net.

This valuable and fascinating volume makes an unusually timely appearance, in view of the widespread and often mischievous ignorance that prevails at a period like the present, when it behoves all sensible people to know something of the country and people with whom we are so gravely concerned. A prominent Cabinet Minister would have thus been spared from speaking light-heartedly about "The balmy air of Far Cathay" had he learned a few cardinal facts of a geographical character as to the climate of that country;

such as, for instance, that at Peking the winter temperature often goes down to 20 degrees below zero, and that even as far south as Shanghai—nearly on the same latitude as Cairo—the cold has been so severe that the river has been thickly frozen over and large numbers of cattle and human beings have perished.

It would probably be highly surprising to party politicians of another stamp who demand that negotiations should be carried on with a section of the people, as if they represented the Chinese nation as a whole, to learn that nearly 90 per cent. of these were illiterate, out of a population of upwards of 400,000,000; that among these there are at least eight dialects in wide and common use, differing as much as English, German, French, and Dutch; and that frequently, among natives of different provinces, the easiest means of oral communication is in "pidgin English"! Among the important items of information made clear in this book is that of the widely differing characteristics of the Chinese of the north and south respectively, due largely to their geographical situation and environment, facts which help largely to account for their variations in psychology and occupations. Suggestive notes will be found on the results of the contiguity of China to its island neighbour Japan, on whose civilization and history it has exercised so profound and varied an influence. To the debt owed—and quite freely owned—by Japan for her ancient culture, must be added even the name by which she is known to the outside world; for the word "Japan" is but a Western corruption of the title "Jihpen" bestowed upon the islands that lay in the path of the early Chinese fishing junks as they sailed out towards the rich fishing grounds surrounding the "Land of the Rising Sun"—Jihpen.

Let it be said, in conclusion, that in this latest edition of 'Things Chinese' we have an absolutely invaluable work of reference to the subject with which it deals. The thoughtful student of such matters will find enlightenment at every turn, for, taken in conjunction with the current edition of the China Year Book, it constitutes a veritable *Encyclopædia Sinica*, a study of which by those members of Parliament who seek to acquire or to impart information inside or outside of the House of Commons upon current affairs in China, can be very earnestly commended.

W. W.

China: Land of Famine.—Walter H. Mallory. New York: American Geographical Society. 1926. 10 × 7½, pp. xvi. + 199. *Numerous Illustrations, including Sketch-maps.* \$4.

The author of this volume, whose preface is dated "Peking, April 6, 1926," and who describes himself as Secretary to the China International Famine Relief Commission, states in his preface that it is, so far as he knows, the first work published in English dealing exclusively with the subject of Chinese famines, and that his purpose has been to set forth "as briefly and understandably as possible, why China has so many famines and what, in his judgment, can be done to prevent them." Whether or not this is the first attempt of the kind in English, it must be recognized that the author has produced a volume demanding the most earnest consideration from all interested in the future of China—one may even say, of the human race.

After a brief Introduction there follow four chapters on the causes of famine under the heads Economic, Natural, Political, and Social; and four on the cures under the same heads. The chapter on the Natural Causes mentions three chief ones—excessive rains, droughts, and locusts. Excessive rains are disastrous in two ways. In the north-west the chief damage is in the washing away of soil, especially where the slopes have been deforested, and the

destruction of terraces made for cropping. Such destruction is naturally most rapid in the elevated parts of the loess area. In the eastern plains, where the slope is exceedingly slight or nil, the devastation is mainly due to flooding, the risk of which places millions of Chinese along the banks of the Yellow River in an appalling situation. Against drought, to which the northern parts are most liable, there is no remedy where irrigation cannot be resorted to, except the old one of Joseph—food storage, and this in imperial times was not neglected. But among the political causes of famine perhaps the most serious is the fact that one of the first results of the overthrow of the Manchu *régime* was the abolition of the public granaries, the maintenance of which for the provision of food against times of need had been a long-established policy of the previous government (pp. 67–8). As for locusts, we are told that in China they have not caused such serious disasters as in some other countries, and that there is some compensation in the fact that in the area most subject to such visitations they are eaten by the people.

Among the general measures required in the fight against famine importance is attached to three. First there is improved transport, of which, however, the author sees little hope in the near future. The cost of extending the railway system in China is, we are told (p. 90), at present almost prohibitive.

Another safeguard against famine urged again and again is the introduction of manufactures, whether as village industries or on a large scale (pp. 19, 125, etc.); but when this remedy is recommended it should never be forgotten that it can operate only in so far as there is the possibility of obtaining the necessary food by the sale of the products. Where adequate food supplies cannot be introduced into a country or region the pursuit of manufactures can at best only have an influence on the distribution of what food is available. This is nowhere expressly noticed by the author, but that it is nevertheless in his mind may be fairly inferred from the emphasis which he lays on the absolute necessity for limiting the growth of the population if there is to be any permanent solution of the problem of famine in China (pp. 4, 183–191). From the last paragraph of the book it is indeed clear that the author feels that in studying famine in China he is dealing with a problem of much wider scope. "Over-population," he says, "is now a matter of world concern. What has occurred in China will, if the human race lets Nature take her course, most certainly occur in other lands which are now prosperous."

G. G. C.

The Sacred 5 of China.— William E. Geil, Litt.D. London: John Murray. 1926. 9 × 6, pp. xix. + 355. *Illustrations.* 24s. net.

The figure 5 appears so often in Dr. Geil's text that it is almost impossible to avoid beginning by stating that it stands for the five prominent holy mountains—Tai Shan, Nan Yo, Sung Shan, Hua Shan, and Heng Shan. The expressed purpose of the book is to study the fundamental motives of nature worship—reaching back to the primitive through the peasant; and accounts of visits to the peaks form its framework. Quotations are numerous, largely drawn from royal edicts and ceremonial usages. They certainly give considerable insight into the spirit of the people—an insight which the reader would still appreciate without the frequent and superficial references to the history of other countries. The book is hardly calculated to appeal to the general reader, though perseverance, or luck, will discover interesting passages, such as the account of the methods of Wan Li, the surveyor.

Through Kamchatka by Dog-Sled and Skis.— Sten Bergman. London: Seeley, Service & Co. 1927. 9 × 6, pp. 284. *Illustrations and Maps.* 21s. net.

In 1920 the Swedish Geographical Society organized an expedition to Kamchatka under Dr. S. Bergman for biological and ethnographical research. This volume is a popular account, translated from the Swedish, of two of the chief journeys undertaken by members of the expedition. Little has been published in English on Kamchatka, and nothing in recent years, so this brightly written and informative book is very welcome. Our main criticism is that it is too short and omits all account of the summer work, possibly because that is a poor season for travelling in Kamchatka compared with the winter. After an adventurous voyage from Japan, including a shipwreck at Cape Lopatka, the expedition made its headquarters at Petropavlovsk, and thence the author moved north by sea to Ust-Kamchatsk. His first journey was southward by the Kamchatka valley and over the Ganal tundra back to Petropavlovsk. The second winter he went north over the same route as far as Klyuchevskoe and then up the Yelovka valley and over the high Stolbovaya tundra along the old post route to Okhotsk, as far as Tigil'ski. From there he turned southward, following the very indifferent west coast route for some 600 miles to Bolsheryetsk and eventually Petropavlovsk. This return march was through the poorest region of Kamchatka and one of the few parts in which the Kamchadals are still to be found retaining their own language, but otherwise dying from the effect of Russian and Japanese influence. Elsewhere in Kamchatka the Kamchadals that remain have mixed with the Russians and adopted their language. Deviations were made to visit the reindeer-breeding Lamuts and Koryaks in the western interior, a people about whom little has been written. Being off the few routes they have come little under Russian influence.

Since Petropavlovsk gave place, first to Nikolaevsk and later to Vladivostok, as the Russian naval station in the Far East, Kamchatka has lost what little touch it had with the outer world and is rarely visited except by a few traders and Japanese fishermen. The routes followed by Dr. Bergman used to be more frequented than they are to-day, and are in fact the only available routes in Kamchatka. They are well dotted with small villages, but conditions are very primitive and civilization is almost at its limits. The chapters on native life are valuable, and the description of the Kamchatkan villages and their communities have considerable geographical interest. It is noteworthy that wherever the author went he was received with courtesy and attention and helped in the pursuit of his researches, not only by the natives and a few Scandinavians he met, but also by the Russians. The book is well illustrated, although Dr. Bergman had the misfortune to lose most of his photographic material at the outset of the expedition. The maps, though small, are adequate. The scientific results of the expedition are now in course of publication in Sweden.

R. N. R. B.

AFRICA

Ancient Egyptian Materials.— A. Lucas. London: Edward Arnold & Co. 1926. 8 × 5½, pp. viii. + 242. 7s. 6d. net.

The author of this book, a well-known chemist, has already earned a reputation that extends to those whose knowledge of chemistry is slight. His book on 'Forensic Chemistry' placed his expert knowledge at the disposal of a public interested in legal questions; the present work performs the same

function for Egyptologists, and should be an indispensable book of reference for any who use Egyptian antiquities as material for historical geography. The scope of the book is indicated by the chapter titles: Building Materials, Glass and Pottery, Metals, Precious Stones, Writing Materials, and many others; but it may be well to mention that only those which lend themselves to identification by chemical analysis are dealt with; neither "food" nor "cereals" can be found in the index, and therefore no light is thrown on the present controversy as to whether wheat as well as barley was cultivated in the earliest times. The method is to "include a description of each material dealt with, its nature or composition, its use and, whenever possible, its place of origin and the date when it was first employed." Full references to authorities are given, with the salient points of published analyses, while many analyses made by the author are given in full in an appendix.

One of the greatest uses of the book will undoubtedly be the correction of errors: for example, Kohl, the black pigment used for painting round the eyes, is constantly referred to by antiquaries as *Stibium*, of which Latin word the usual equivalent is antimony. One can imagine a student of ancient trade-routes ascertaining that antimony ores do not occur in Egypt but are well developed in Persia, and deducing a trade between the two countries dating from the period of the earliest known use of Kohl: Mr. Lucas finds that in practically every instance he has tested the Kohl is Galena (sulphide of lead), and probably of Egyptian origin. On the other hand, a connection with Persia from Archaic times onward is suggested by the use in jewellery of lapis lazuli, though later an artificial substitute coloured by copper obtained from Sinai was commonly employed; the use of orpiment as a yellow pigment, the probable source of which was Asia Minor, where it occurs naturally, is also confirmed. We may regretfully agree with the author in his discussion of "Alabaster": to the mineralogist or geologist the word always refers to a form of calcium sulphate; objects of "alabaster" are constantly referred to by Egyptologists, but the substance is always a carbonate of lime, for which the term "stalagmite" should be used; but the misnomer is too well established to be altered.

The short and modest summary at the end of the book, based on the great number of accurate details, is a valuable contribution to the history of civilization. Early Egypt must always be the great example of a copper age; tin does not occur, and therefore bronze or, later, tin ore to combine with the copper from Sinai for its manufacture, was an import. Before entering on an iron age Egyptian civilization was already decadent. Of materials imported up to the period of foreign conquest in the Eighteenth Dynasty a few came from the south, but a large majority from Western Asia, and very many of these from Asia Minor, a land which may still hold many a secret for future research when opportunity offers. We congratulate the author on the publication of so much useful work.

C. N. B.

Dictionnaire des Noms Géographiques contenus dans les textes hiéroglyphiques.— Henri Gauthier. Vols. 1-3. Cairo: Royal Egyptian Geographical Society. 1925-6. 11 x 9. Vol. 1, pp. viii. + 218; 2, pp. 170; 3, pp. 156.

This work, dedicated to H.M. King Fuad, is intended to replace Heinrich Brugsch's great *Dictionnaire Géographique de l'ancienne Égypte*, which appeared half a century ago. Much progress has been made in Egyptian knowledge since then, and M. Gauthier's work is very acceptable as recording this progress

in the domain of geography. The work will consist of six volumes, of which he first three have now appeared.

We cannot help regarding it as regrettable that in a scientific work of international interest and value the author should have used an old-fashioned and unscientific transliteration of ancient Egyptian, and one intended moreover apparently only for French-speakers. Thus the French *ch* is used instead of *š* for our *sh* sound, German *sch*, Italian *sci*, French *ch*: in a scientific book the international equivalent *š* should have been used. The French *ou* similarly is used for *u*. Nobody else pronounces either *ch* or *ou* as the French do. And side by side with this we get such a very "scientific" transliteration as *q* (without following *u*) for the sound corresponding to ق, while *h* and *kh* are also used. Why then *ch* and *ou*? One does not ask for the algebraic symbols of the Germans, *3*, *c*, and the rest; but one does expect the elimination of pure gallicisms like *ch* and *ou*, and the adoption of a logical system and one that will more or less produce the same results on the tongues of all readers.

This is the chief criticism we have to make of the book, which will doubtless be very useful to students. Work of this kind can never be absolutely exhaustive, because it is impossible for any author to cover the whole ground of the literature and archæology of an ancient nation in order to collect from it all the mentions of a particular subject such as geography. He can only "faire son mieux," as M. Gauthier has indeed done, with excellent results. And his reviewers can help him in his work by suggesting corrections or additions for an addendum at the end of the work, or a second edition.

Thus, under the heading *Assur* (M. Gauthier of course writes "Assour"), we find the first mention of Assyria apparently given as the annals of Thutmosis III. at Karnak. But there may be an older mention. M. Gauthier quotes from Sir E. Budge's 'Egyptian Dictionary,' p. 964, the locution *pa-Assur*, "the Assyrian," but he does not know the reference for this phrase, which Budge does not give. It is to be found in a hieratic ostrakon, found by Hall at Dair al-Bahri in 1904, and probably of the reign of Hatshepsut, which mentions "the Assyrian (*pa-Assur*) who works in turquoise," a slave or other immigrant, evidently. (Published by Hall in Naville-Hall, 'XIth Dynasty Temple at Deir el-bahari,' iii. p. 18.) This is probably the oldest Egyptian reference to Assyria.

It is possible that further search might bring to light other instances in which M. Gauthier's references could be extended, but generally it must be said that his modern additions, to Brugsch's identifications and to the mass of references on the subject are well considered and useful. H. H.

Rapports des Missions organisées par la Société d'Études du Chemin de fer Transafricain publiés par les soins de la Société de Géographie. 3 vols. **Mission du Transafricain.** Rapport du Capitaine Nieger, Chef de Mission (pp. xii. + 334). Notice sur le Sahara Soudanais, par le Capitaine Cortier. **Rapport Géologique et Hydrologique**, par M. R. Chudeau (pp. 130). *Maps and Illustrations.* Also Carte des Régions parcourues. Société d'Éditions Géographiques, Maritimes et Coloniales. 1924-1925. 11 × 7½. £1 19s. 6d.

The expedition with which this report deals was undertaken several years before the war, which delayed its publication until 1924. The work as it has finally appeared, together with the late M. Chudeau's monograph on the geology and hydrology of the Central Sahara, and the maps which accompany the letterpress, constitute, among many notable productions of the kind, the

most important geographical compilation which has yet appeared on this part of the world's surface. The object of the expedition was to determine the route of a trans-African railway from Southern Algeria to Lake Chad. Whether many or any of the ten European members of the expedition seriously believed in the practical possibility of constructing such a line does not appear; they were directed to find, and so conscientiously explored, a route. Since 1912, when the survey was undertaken, much important development has taken place in the world of transport; the track automobile has rendered trans-Saharan railway projects even more illusory than they perhaps already were. The route chosen by Captain (now Colonel) Nieger and his collaborators does not therefore call for serious critical examination. Almost the most difficult country encountered all the way from Adrar in Tuat to Chad was in the Damergu and Elakkos bush south of Aïr. The obstacles they found in procuring guides and discovering anything definite about this country added to the problem of taking a railway bed over a very uneven surface of what probably was once dune-land but which has long since fixed by dense subtropical scrub. It occurs to one to wonder why a route which avoided Zinder and ran more or less directly from Agades to Chad was chosen in preference to one which, after proceeding almost due south of Aïr, could, without greater difficulties of terrain, have skirted the Nigerian frontier, across which a short branch connection to Kano would have given a more direct and economically fruitful access to the sea at Lagos. Fears that the Nigerian railway might divert the trade of the fertile French belt along the boundary between the Middle Niger and Chad, into British territory, may have been a consideration; but no railway to the lake with any pretence of economic responsibility could ultimately have avoided such a junction somewhere, however far along its route it attempted to keep clear of proximity to British territory.

The importance of the railway survey is, however, insignificant compared with the value of the geographical data obtained. A chain of astronomical points from Tuat to Lake Chad was determined. A wide belt of country was surveyed by route traverses hung upon these astronomical coordinates. Seventeen 1/400,000 sheets have been produced and well printed. The more detailed maps upon which they were based are available for reference in Paris. This material is among the principal used for the French 1/1,000,000 Croquis du Sahara now in progress.

Among the special studies prepared, M. Chudeau's summary on dunes and dune formation is particularly interesting and concise. The letterpress of the report deals essentially with geographical matters; the accounts of the sections surveyed are detailed but very clear. The whole publication is a model of what good French geographical work can produce. It is of the greatest credit to all concerned, and not least to the Société de Géographie which has been responsible for its public appearance. Before the war M. le Myre de Vilers, as President of the Société, commenced editing the work; M. Grandidier, the present secretary, brought its publication to a successful conclusion. If, as may be presumed, they are responsible for the final form, they deserve the congratulations of all geographers, for it is worthy of the best French traditions in North Africa. It is said that means did not permit of all the material collected being published—more's the pity. Nevertheless it requires little imagination to read between the lines of the text many of the hardships and dangers encountered by the members of the expedition. The account of critical weeks spent in Northern Elakkos recall so vividly scenes

and times which the reviewer experienced there, that he can only regret, for the reader who does not know this horrible country, the modesty which forbade these French officers in their report giving more than a very matter-of-fact account of their adventures.

F. R. R.

Out in the Blue.— Vivienne de Watteville. With a Preface by The Hon. William Ormsby-Gore, M.P., P.C. London: Methuen & Co., Ltd. 1927. 9 × 6, pp. xvi. + 254. *Seventy-seven Illustrations and a Map.* 18s. net.

This book is a narrative of a hunting expedition. Moreover, it tells of an unfortunate tragedy and reveals a fine example of personal achievement. Mr. Ormsby-Gore supplies a preface in which he bears witness to Miss de Watteville's fortitude and warmly recommends her book to the public.

The expedition took place in 1923, and traversed Kenya Colony and Uganda. Bernard de Watteville and Miss de Watteville, father and daughter, are the moving spirits throughout the enterprise. They received support from the Berne Museum, and their main purpose was to enrich this institution with examples of African fauna. Shooting is therefore the substance of the book. Tracking, chasing, killing, skinning—these are the main objects of activity and interest. The account of them is full of life and energy. There is no lack of industry and enthusiasm, and courage amounting to some degree of recklessness. Whatever else we may think, we must admire the girl who will stand in the open before a bull elephant and photograph it at a distance of 10 yards. All kinds of animals fall before the hunters—lions, elephants, rhinoceroses, giraffe, and the whole gamut of African game. The Berne Museum benefited by 121 specimens. They could scarcely have wanted nineteen lions.

Unfortunately, a great tragedy marred the enterprise. Bernard de Watteville was charged by a lion and killed. In his death he displayed great fortitude, walking for over two hours after having received a terrible mauling. From this point to the conclusion of the narrative Miss de Watteville becomes the central figure. And it is in her remarkable initiative and resourcefulness that we find the main interest of the volume. Her position is unenviable. A girl of twenty-four, her father killed, she is alone in Central Africa with no companion but native porters. How many girls would not give way to despair, or at least would have only one idea, to get to the coast by the shortest route? Not so Miss de Watteville. She takes command, exerts authority, determines to continue the enterprise and complete her father's work. There is nothing half-hearted in her efforts. Her men are hungry, she shoots meat for them; they are insubordinate, she has them flogged, and stands over them to see the flogging done; the expedition is incomplete without a white rhinoceros, she persists until one is slain. Though all who read the book may not care for so much shooting, yet not one will deny to this inflexible purpose their feelings of genuine admiration.

R. W. G. H.

AMERICA

Canada: The Great River, the Lands and the Men.— Marion I. Newbigin, D.Sc. London: Christophers. 1927. 9 × 5½, pp. xii. + 308. *Maps and Illustrations.* 12s. 6d. net.

This is probably the most brilliant book dealing with the history of Canada that has yet been written. Dr. Newbigin has a very happy faculty of getting down to hard rock and stating in simple terms conclusions drawn from much historical data. No doubt this is due in this instance to her wide geographical knowledge, which, perhaps for the first time, has been brought to bear on

Canadian history. In any event the result is certainly most entertaining. Never has the French period of Canadian history been treated in anything like the same interesting manner while resting at the same time upon the bedrock of sound historical data.

After describing the explorations of Cartier and Champlain and the slow growth of the Colony down to 1668, Dr. Newbigin gives, in chapter vii., a most original account of the "Motives and Means of French Expansion." She points out how the efforts of the French to form new alliances behind the Iroquois were checked throughout by the efforts of the Iroquois "to extend their own hunting-grounds at the expense of the tribes allied to the French" (p. 123). The result of course was that the French "advanced into an area too extensive for effective occupation" (p. 127). Although "it was La Salle's misfortune that so many of his schemes were in advance of the times" (p. 137), yet it was also true that "he was trying to do alone what the Hudson Bay Company, with much larger resources, did much later in the north."

Another brilliant chapter is No. xi. on "A New French Policy and an Inconclusive War." "Throughout the French period," we are told, "Montreal was only a postern gate through which small parties of traders, missionaries, and explorers sallied forth, followed intermittently and reluctantly by officials and soldiers always liable to be recalled on an alarm. Obviously the lands reached in this fashion could not be held, once the antagonism of the English had been thoroughly aroused" (p. 217).

Illuminating comparisons are also made between the English and French ways of doing things, such as the loopholed trading station of Fort Oswego in 1727 and the massive French fort at Crown Point built in 1731 on definite English territory, and between the English method of settlement by which small parties pushed out into the apparently illimitable backwoods and the French system of *coureurs de bois* living more or less with the Indians.

Dr. Newbigin's description in chapter xii. of the fundamental problem whether the Central low plains were to remain hunting grounds or were to carry a settled agricultural population is also most illuminating. In fact, in many ways this is one of the best chapters in the book, being comprehensive, clear, and accurate.

Dr. Newbigin's conclusion is that "while man can modify to some extent the lands in which he dwells, in other respects he must follow where nature leads" (p. 284). With regard to New France, "The history of French Canada was a story of ineffective advances into the surrounding wastes from a more or less static centre, and its fall was the result of the attack on that centre by a power strong on the sea, the element to which Canada had such limited means of access" (pp. 269-270).

The illustrations and maps add greatly to the pleasure of reading this interesting work. The only errors noted are one or two mis-spellings in the Table of Contents, which was evidently not drawn up by the author.

H. P. B.

Pedro, de Valdivia, Conqueror of Chile.— R. B. Cunninghame Graham.
London: William Heinemann, Ltd. 8½ × 5½, pp. 220. 15s. net.

Mr. Cunninghame Graham has, this time, taken for his theme the work of the Spanish conquistador Pedro de Valdivia, who, following the ill-fated old hero Almagro, succeeded in holding militarily, and in settling at least the central part of, what is to-day the Republic of Chile.

The story of Valdivia's endless efforts, and of his poor rewards, makes no such glowing and moving relation as, for example, that of the conquest of Mexico; for here was no permanent civilization, no shining cities, and no wealth to repay toil and exile; nor was there peace and plenty when the sword was turned into a ploughshare. The settlers struggled perennially, with none but the Santiago and northerly regions secure from attack, against the relentless hostility of the nomad Araucanians; stories of outpost forts burned and settlers murdered or carried away to an unknown fate are repeated again and again in the records of long periods in Chilean history; and the historian, who has always admired the Araucanian for his resistance, is apt to ignore the courage of the would-be European settler. Mr. Cunninghame Graham scarcely does justice to Valdivia's qualities as an organizer and peopler of the land in his charge; but he has done good work in translating and presenting the five extant letters of Valdivia to the Emperor Charles V.

The Distribution of Bird-life in Ecuador: a contribution to a study of the origin of Andean Bird-life.— Frank M. Chapman. (*Bulletin of the American Museum of Natural History*, vol. 55.) New York. 1926. 9½ × 6½, pp. xiii. + 784. *Illustrations and Sketch-maps*.

Mr. F. M. Chapman, Director of the Division of Zoology and Zoogeography in the American Museum of Natural History, has edited another of the Bulletins for which that great institution is so deservedly famous. Volume Fifty-five, 'The Distribution of Bird-life in Ecuador,' is the proper continuation of a similar volume on the neighbouring country of Colombia. The task which these naturalists have set themselves is "to ascertain the effects on the distribution and evolution of bird-life of the elevation, in comparatively recent geologic times, of a mountain system, the central base of which lies near the equator while its summits reach perpetual snow, the wings extending continuously to the Temperate Zone at the south and, with some breaks, to the same zone at the north." Mr. Chapman points out that a large area of Andean Ecuador is imperfectly mapped and that geologically there is still a vast field for exploration. The means at the disposal of the American Museums make British mouths to water: the methods and the results of the disposal compel admiration.

A. F. R. W.

AUSTRALASIA AND PACIFIC ISLANDS

Life and Laughter 'midst the Cannibals.— Clifford W. Collinson. London: Hurst & Blackett, Ltd. [1926.] 9 × 6, pp. x. + 288. *Twenty-four Illustrations*. 18s. net.

The Wreck of the "Tropic Bird" and other South Sea Stories.— Frank Burnett. London: Sifton, Praed & Co., Ltd. 1926. 9½ × 5½, pp. 113. *Illustrations*. 6s. net.

Neither of these two volumes can be regarded as a book of reference. 'Life and Laughter 'midst the Cannibals' is a popular work, so popular, in fact, that one is tempted to assume that the author took as his model 'Three Men in a Boat'—to say nothing of the cannibals; and indeed not much is said of the cannibals, except as servants or customers of the white man, speaking pidgin English, and providing food for laughter. The author has a lively style, and those who are tired of the romance and the ethnography of the Pacific may find relief in his fun, if they can overlook his facetiousness. He would certainly disclaim any intention of writing for highbrows, though even some of these may be willing to accept "black fella mary along shovel" as

an alternative title for the Queen of Spades. To winnow the wheat from the chaff must be left to those whose interest in the Solomon Islands quickens their enterprise. It is certainly a book that can be read with amusement, and it contains information that is of value.

Mr. Burnett's book is very different, both in manner and in matter. Nearly half of the slender volume is taken up by an account of the voyage and eventual wrecking of the "blackbirding" schooner *Tropic Bird* in 1893. The vessel was in the first place unhappy in its experiences with the Solomon Islands natives, a portion of the crew being massacred off Malaita. The ship was afterwards cast away on the Indispensable Reef, which is submerged even at low tide, and then followed a two months' struggle against heavy odds, with eventual rescue. In spite of a halting and precarious literary style, the author tells the story with some effect, and it seems probable, though it is not stated, that he was one of the castaways. Most of the rest of the book is devoted to the characters and doings of "gods and demons" of the South Seas, either as described to the author by natives, or constructed from data obtained in Fiji and elsewhere. There are interesting points in these chapters, together with some shark, and "shark-god," stories which were worth recording. A final chapter gives an account of the making of mats and bark cloth in Pacific Islands, though the description is too generalized to be of much value.

H. S. H.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Field Astronomy for Engineers and Surveyors.— David Clark, M.A., B.Sc.
London: Constable. 1926. $7\frac{1}{2} \times 5$, pp. viii. + 164. *Illustrations*.
10s. 6d. net.

As the author remarks in his preface to this little book, it is largely a reprint of chapters i. and ii. of his 'Plane and Geodetic Surveying,' vol. 2, 1923. It is intended as a reference book for those whose practice of field astronomy is occasional, and their knowledge therefore somewhat rusty. It is also designed as a text-book for students of Surveying and Elementary Geodesy.

There are three chapters, dealing respectively with Principles, Instruments, and Observations. The chapter on instruments is clear and concise, and read in conjunction with the instruments themselves most useful. But it is a pity that no mention is made of modern types of theodolites, such as the "Wild" and "Zeiss," which will probably take the place of the older patterns before long. The whole book is well arranged, being divided into paragraphs under appropriate headings; the worked examples, as well as the questions and answers at the end of chapters i. and ii., enhance its value. There is a good bibliography for inquirers after further information, and three useful tables. The table of contents and index are full and clear.

The price of this useful little book is open to criticism. At half a guinea it is the type that an unscrupulous friend will borrow and forget to return.

K. M.

Adjustable astral planisphere for latitudes 40° (80°) N. to 10° N.: accompanied by brief explanatory instructions.— J. C. Clancey, I.S.O.
Bombay: "Times of India" Press, and other agents. [1926.] 15×14 .
Rs.2.

For surveyors and others interested in stellar observations it is frequently desirable to know, in a general way, what stars are above the horizon at any time, and their approximate positions in the heavens; and for this purpose there could be nothing better than a suitably mounted celestial globe if it were

not so bulky and inconvenient to carry about. The next best thing is doubtless a planisphere, but as ordinarily designed these are only serviceable for the few special latitudes for which they have been constructed.

Mr. J. C. Clancey, I.S.O., who for many years has been connected with the Survey of Burma, and has published several works, including a volume of tables, for the use of surveyors in that country, has lately brought out an improved form of planisphere which can be easily made to suit any latitude. It consists of a circular polar-equidistant star chart, around the circumference of which are given the months and days of the year, and which is centred to revolve upon another circular disc, of slightly larger diameter, upon the circumference of which the hours are marked. Covering these two discs, and fastened to them at the upper edge, is a sheet of cardboard upon which has been drawn the curves for the apertures representing the horizons at various latitudes, so that instead of the planisphere having one fixed aperture for a definite latitude, it can be made suitable for any latitude by passing a knife round the curve line corresponding to that latitude. These curve lines are drawn for every 5 degrees, and it would of course be easy to follow the curve round for any intermediate latitude. The present "Adjustable Astral Planisphere," as it is called, is especially made for latitudes 10° to 40° N., but supplementary curves are given on a sheet of tracing cloth, for latitudes 40° to the North Pole.

The scheme seems a good one, and should bring the planisphere into more general use; there is room for improvement in the construction, however, especially as regards the star map, which might easily be much clearer.

E. A. R.

Enzyklopadie der Erdkunde. Paläogeographie.— Edgar Dacqué. Paläogeographische Darstellung der Theorie der Kontinentalverschiebungen.— Alfred Wegener. Leipzig und Wien: Franz Deuticke. 1926. 10×7 , pp. viii. + 196. *Thirty-one Text-figures.* G.M.10.

This book consists of two independent essays upon the geography of the past by two independent authors. Professor Wegener's contribution, however, is no more than a short summary of his views appended at the request of the editor of the series to which the volume belongs. It occupies only sixteen pages, but it is enough to indicate the difference in the attitudes of the two authors. Professor Dacqué is impressed with the difficulty of the subject and sees no certainty amidst the multitude of conflicting views; for Professor Wegener there is only one view and no uncertainty. Professor Dacqué attempts no cartographical reconstructions of the geography of the past; Professor Wegener gives several, and adds a diagram showing the changes in latitude of several town-sites since the Carboniferous period. In short, Professor Dacqué is still looking for the truth: Professor Wegener has no doubt that he has found it.

Professor Dacqué's work is not intended for the specialist, but for those who wish to get a general view of the subject. He is concerned with principles rather than with results. His aim is to place the problems fairly and clearly before the reader and to explain the methods by which they have been, or may be, attacked. He conscientiously endeavours to keep his statements free from bias, and on controversial matters he seldom expresses an opinion of his own. His attitude, in fact, is that of a judge summing up before a jury. It would be interesting to know what he thinks of Wegener's theory. In a little popular book published in 1919 he was inclined to look to it as the probable solution of

many puzzling problems. In the present volume he is neither an opponent nor a supporter.

At the beginning of each of his sections Professor Dacqué gives a useful bibliography. The references, however, are chiefly to German publications, and much interesting work in English and French receives no notice. No doubt the book was to be kept within fixed limits, and was intended primarily for German readers. P. L.

An Outline of Plant Geography.— Douglas Houghton Campbell. London: Macmillan & Co. 1926. 9 × 6, pp. ix. + 392. *Illustrations*. 17s.

The author of this profusely illustrated book disarms criticism in his preface by stating that he is "in a way, an amateur," and "can hardly lay claim to rank as a plant geographer." He goes on to say that his book is intended for the general reader interested in the study of plant distribution, also as a book of reference for botanists, "or as a text in classes studying the general subject of plant geography." We are concerned here only with the first and last of these three groups of prospective readers, and have no hesitation in saying that the first is most likely to gain from the perusal of the book. Professor Campbell has travelled widely, particularly in tropical and warm temperate regions, in search of botanical material, and has kept detailed notes of his observations everywhere. Some of his descriptions of areas of rich vegetation, in particular those of some of the great botanical gardens of the world, are vivid and striking, and his constant comparisons between conditions in the regions visited and those in his own State of California are especially interesting to English readers. As a supplement to existing text-books in the English language—still too few—his book should also be noted by students; but it cannot be regarded as in any sense a text-book.

If, as is usual, plant geography is defined as the study of plant communities in relation to the habitat factors, then the book does not in the strict sense deal with this subject at all, but merely with floral regions, a different topic. Even so the treatment is not systematic, for no attempt is made to characterize the regions by giving concise accounts of the endemic species, genera, or families. Repetitions are frequent; the treatment of climate and relief is perfunctory in the extreme, and many will be tempted to apply a harsher term to the index. Composition and punctuation are so careless as to leave doubt in some cases as to the meaning intended, and many paragraphs read as if they had been transcribed from rough note-books without adequate revision. No attempt seems to be made to define technical terms which might offer difficulty both to the general reader and to the college student. There is no list of illustrations, and some of these are so indefinite as to be almost valueless. But, we may repeat, taken for what it is, essentially an account of personal observations on the floras of many parts of the globe, the book fills a useful place.

Visitors from this country to North America who found their first journey in a "street-car" a nightmarish experience, will be interested to learn that Professor Campbell regards chewing gum as "one of America's noblest products." The assertion in the same sentence that chicle, its basis, is derived from some of the "many important *fruits* of the Amazonian region" is but one instance of the dangers of the author's habitual slackness of phrasing.

M. I. N.

HUMAN AND HISTORICAL GEOGRAPHY

National Frontiers in Relation to International Law.— Colonello Vittorio Adami, translated by Lieut.-Col. T. T. Behrens, R.E. Oxford: University

Press. 1927. $9\frac{1}{4} \times 6\frac{1}{2}$, pp. viii. + 127 + xi. *Frontispiece and Sketch-maps.* 10s. 6d. net.

Boundary Commissioners fresh from their task of demarcation generally have something to tell us of the troubles they have had in interpreting the ideas of those who framed the treaty of delimitation, and who described, on paper, with a wealth of topographical detail, the boundary in question. To get an idea of what delimitation should aim at, how much it should leave to the boundary commissioner and how it should be put down on paper, we have had in the past to turn over these accounts one after another. In one of them we may find the difficulties of the "median line" of a stream, in another perhaps the relative merits of the watershed and the crest—but so far there has been no general summary or text-book that a commissioner may carry in his pocket to consult in the many difficult questions he has to solve.

However closely two bargaining powers may attempt to describe a boundary on paper, there will always remain much to decide on the ground. In fact, the history of boundaries, generally, shows far more numerous and serious differences of opinion due to over-detailed delimitation than to the disagreements on the ground of responsible commissioners. The history of our own boundaries bristles with examples of this sort. Boundary commissioners, in fact, should not only "demarcate," they should "delimit" too, and any treaty which does not leave licence for their delimitation in detail is singularly unwise. Since the war we have had one boundary after another to consider, and the need for a commissioners' text-book has become more apparent day by day. Colonel Behrens' translation of Adami's book comes therefore singularly *apropos*.

In a series of short concise chapters Colonel Adami describes the various types of frontiers, and contrasts their merits and dangers. His illustrations are mainly drawn from continental history, but they can all be paralleled in our own experience and will be paralleled again. Interesting chapters deal with sea frontiers and with the air frontiers of the future. The chief criticism one may make is that the subject is treated perhaps too logically and too little humanly. That defect is however remedied by Colonel Behrens' own contribution in an appendix "on practical questions."

The securest frontier is obviously that one which gives the greatest satisfaction to all and which removes cause for local friction. There is, for example, on record the case of a boundary so drawn as to divide, somewhat arbitrarily, the lands of a West African tribe. With many mysterious rites the tribe in question uprooted the boundary pillars and planted them again so as to include the whole within British territory. It was a compliment but a troublesome one, and a proper award should have made it unnecessary. These human aspects of delimitation and demarcation on a watershed boundary are Colonel Behrens' text, and are a welcome complement to Adami's colder reasoning.

A fairly full bibliography and a well-compiled index finish off the book, which is well bound and handy in size.

All the boundaries we have to consider are not however international, and the same mistakes (almost all of geographical origin) are to be found in tribal and district questions as in international. This book should, then, find a wide audience in colonial administrations and survey departments as well as amongst boundary commissioners, and, one hopes, may even find its way to the tables of those who, generally on inadequate topographical evidence, have to discuss the preliminary political delimitation. H. S. L. W.

Cotton and its Production.— W. H. Johnson. London: Macmillan & Co. 1926. 9 × 6, pp. xxviii. + 536. *Maps and Diagrams.* 30s. net.

Here is a book which imposes itself on you whether you will or not; and, in doing so, it challenges you to judge it from a corresponding altitude. It greets you with an Introduction by Sir Wyndham Dunstan, a Foreword by Sir William Himbury, and a Note by the author; it has seven pages of Contents and four of Bibliography, a score of attractive coloured maps and a number of black and white diagrams, and an aggregate of 558 pages; it weighs 42 solid ounces, and it costs 30s. net.

This is very imposing. Professor Dunstan's authority, especially in the matter of cotton, is enough by itself to make one think at once of buying the book; Sir William Himbury, besides his own tale of good work in many lands, carries the whole weight of the British Cotton-growing Association behind him; and the publishers, as one expects of the Macmillans, have turned out a book really attractive to the eye.

And yet a preliminary "run" through the book left one unimpressed and even somewhat seriously in doubt—doubt not only as to what readers wanted just such a book, but also as to the trustworthiness of the book itself. Amongst the author's acknowledgments the name of Professor Todd does not appear, *nor in the Bibliography*; even the 1921 Report, which he edited, is omitted from the list of Official Reports. The index is even more unsatisfactory. Seven pages of Contents may be an easy excuse, but are no compensation, for a *four-page* index. A geographer may reasonably want to look up some special place, *e.g.* Hubbli, Nantungchow, Torreón, La Chisa, Resistancia. He will get no help from this index, nor from the seven pages of Contents.

Nor can the book be praised from the geographical standpoint, for some of the geographical details are very carelessly handled, even if they are not actually incorrect; and this is true of all parts of the World, though much less so about those for which there is an abundance of published material well documented and correlated.

On p. 226 the Russian Turkestan cotton area is described as "east of the Caspian Sea, north and west of the Himalayas, and south of latitude 43° N." In casual conversation, we may say that one place is west and north of another when we mean that it is west of the longitude and north of the latitude of the other. But is it pardonable to describe a cotton-growing area as east of a sea, *i.e.* an apparent source of humidity, when you mean 800 miles east of it, 500 of them over one of the starkest deserts in the world? The passage goes on to say that this is the most northerly cotton area in the world excepting some districts in China and Korea. But the author's own maps (pp. 219, 225) show cotton growing 200 miles farther north along the Sir Daria than in Chihli, though they don't make it clear that the Chihli cotton is too short to be spun at all!

South America, in spite of all Mr. Pearce's admirable work on it, is treated in a very wooden and unintelligent way. The whole of Brazil is described as in one "tropical and subtropical zone" (p. 192), and then this is divided into three so-called *climatic* zones, which are decided by temperature only. On the other hand, the continuous riverine lands of what is persistently called the *San Francisco* (as though the area was not Portuguese) are not treated as one "zone," though the most important factors are the irrigation and the transport supplied by the river, and though the upper basin is as distinct from the lower as a cotton-growing area, as it is from the Tieté basin. In a similar way, we

are told (p. 364) that the mass of the Colombian cotton is grown near Barranquilla, but "a small quantity is also grown in the Goajira Peninsula." Surely the word "peninsula" might have suggested the truth—that it is in the even climate of Goajira that Colombia grows far the most important part of its crop, the famous "Sea-island." Again, in the case of Peru we are told that "during the summer fogs occur which occasionally result in rain, but the precipitation is of no importance" (p. 369). But is the relative humidity also of no importance? There is no reference to it, though we are told that "the temperature is moderated by Humboldt's current"—another rather curious wording.

The treatment of African areas is better, but the details are still rather apt to be misleading. For instance, Ashmouni, as it is called, is quite rightly praised, and its rapid extension in Upper Egypt is noted (p. 169); and at the same time it is admitted that over two-thirds of the total cotton area is in Lower Egypt, where Ashmouni only occupied 13.3 per cent. of the area in the latest year quoted by Mr. Johnson—1921. But the unwary reader would never gather that owing to its short staple Ashmouni cannot be used for some purposes at all. A rather similar misconception may result from the pages on the Union of South Africa (p. 269 and the map opposite). The map distinctly suggests that the most important areas are those of Waterberg and Swaziland, followed by the Spelonken; the text, based on 1920 (!) results, suggests that Natal is the most important. On p. 270 Rustenburg is associated—wrongly—with the Waterberg as one of "the most promising areas," but neither Barberton nor Ngotsha is mentioned at all. Rustenburg gives 40 per cent. of the crop, but Ngotsha (not on the map) gives 20 per cent., and Barberton 17 per cent.

The reviewer would suggest that the word used by Sir Wyndham Dunstan—encyclopaedic—really betrays the weakness of the book, at all events from the purely geographical standpoint. For it was really an impossibility to cover satisfactorily all the intricate and multitudinous aspects of the subject in a single volume by a single hand.

L. W. L.

Pero Tafur, Travels and Adventures, 1435-1439.—Translated and edited with an Introduction by Malcolm Letts. *The Broadway Travellers*. London: Routledge. 1926. 9 × 6, pp. xvi. + 262. *Maps and Illustrations*. 12s. 6d. net.

The new series of "The Broadway Travellers," of which this is the first volume, is designed by its editors, Sir Denison Ross and Miss Eileen Power, to contain translations and reprints of interesting books of travel which have hitherto been inaccessible in English or have been unduly neglected. Pero Tafur's work was an admirable choice with which to open the series, for in its importance and interest it deserves to stand high among the narratives of mediæval travel. Only a single eighteenth-century manuscript copy is now known to exist in Spain, and even this is imperfect; but the researches of Spanish scholars have cast some additional light upon the life of the author, and he is shown to have been a man of some importance in his native town of Cordova, and to have lived there until his death in 1484. His travels were undertaken between 1435 and 1439, when he was between twenty-five and thirty years of age, but he does not seem to have completed his account of them until after the middle of the century. The book can never have had an extensive circulation, and it had to wait for its first appearance in print until

1874, when an edition was published in Madrid by Jiménez de la Espada. It is this version that Mr. Letts has now translated into English for the first time.

Tafur was essentially a man of the middle ages, and the world in which he travelled was still the restricted centripetal one that looked inwards to Jerusalem as its hub. There is hardly a hint of the Renaissance in his pages, and men's thoughts still turned to the long struggle between Christendom and Islam as the dominant factor in the world. As one of possibly Moorish descent who claimed to have the blood of the Palæologi in his veins, Tafur was well fitted to give us a picture of the protagonists in the last conflict round the corpse of the East Roman Empire. He met most of the great men of his time: the Grand Turk, Amurath II., the Sultan of Egypt, the Emperor Albert II. of Hapsburg, the unfortunate John VIII. Palæologus, Pope Eugenius IV., the degenerate descendants of the Comneni, and so on. Each of them he sums up in a few well-chosen words, and these character sketches add greatly to the interest of the narrative. The Spaniard was a much shrewder observer and much less credulous than the pilgrim travellers of earlier centuries, who have left us narratives of their visits to Jerusalem and the Holy Places. He was a good Catholic, as became a Spaniard, but he had more interest in politics and commerce than in mere devotional sight-seeing, and his comments frequently cast a light on the movements of world trade in his day that lends considerable historical value to the book.

Tafur not only visited the Near East and the countries round the Mediterranean, he also journeyed into the Low Countries where Philip the Good was building up the most stable and prosperous state of the time. He went through Germany, Bohemia, and Hungary as far to the north-east as Silesia, and gives us a graphic picture of Breslau, the great and wealthy city on the Oder, where he tells us that the people could expend more money upon furs and spices than in half the world besides because they derived so much silver from their mines. Everywhere he met friends whom he had encountered before upon his travels, and we gain from his pages a vivid impression of an intimacy of intercourse between all parts of Christendom that can hardly be matched in our own time. His comments upon the facilities afforded by the system of international finance, whereby he was able to obtain bills of exchange payable in any part of Europe, have a curiously modern flavour, and enable us to realize much that has been slurred over or neglected by other travellers.

The translation seems to have preserved the clarity and simple directness of the original, and it is eminently readable. The illustrations are chosen from a variety of fifteenth-century manuscripts, and are of intrinsic interest but not directly connected with the text. The production of the book is all that could be desired, and the editors and publishers are to be congratulated on their effective use of red and black in the title page and other preliminary matter. The standard of the new series has been set high, and if the other promised volumes come as near to it as does the first, we may look forward to a really valuable addition to the literature of travel.

A. P. N.

Sir Francis Drake's Voyage Around the World, its Aims and Achievements.— Henry R. Wagner. San Francisco, California: John Howell. 1926. 11 × 7½, pp. x. + 543. *Maps, Charts, and Facsimile Reproductions.* 45s. net.

This is a large exhaustive work on Drake's voyage round the world, put together with infinite labour and with an honest determination to arrive at

an unassailable verdict on the available accounts of that achievement. In fact, no document and no map or plan seems to have been overlooked by its indefatigable author. Mr. Wagner also evidently considers that his efforts entitle him to express decided opinions, and he has had no hesitation in stating them on all points, controversial or other.

As in the case of every other work of the nature of that before us, this book presents two aspects—statements of facts collected with ungrudged trouble, and judgments on the facts collected. As regards the collection of his facts Mr. Wagner's labours are beyond praise. He does not appear to have left anything out when considering the voyage in twelve chapters of his book. He describes at length its objects as he sees them and the preparations for it, and the journeys across the Atlantic to both coasts of the American continent round Cape Horn from Brazil to California, thence across the Pacific to the Moluccas, and thence home. He then gives an account of what happened after the return home, and adds to Drake's voyage the story of the later Fenton expedition. The statements made in the course of the account of the voyage itself are supported by an examination of no less than twenty-two "texts," English and Spanish, and about seventy maps, charts, and illustrations. Four portraits of Drake are also given, besides eight appendices, and an immense number of notes in very small print to the Introduction and the twelve chapters. Many of these notes are very valuable and must have demanded great research: *e.g.* those on Drake's age (p. 457), Juan the Greek pilot (p. 477), Cape Mendocino (pp. 490 ff.), Drake's Bay (p. 495), Spanish Money in the sixteenth century (pp. 506 ff.), Drake's portraits (p. 508), and others. There seems to be no doubt that Mr. Wagner has done his best to read and examine all available sources of information.

The maps which have been so lavishly reproduced in this book have in many cases been so reduced from the originals and so printed that they cannot be read even through a magnifier. They are, in fact, blurred, which is a very bad defect in map-making. The reviewer tried to find a place in the neighbourhood of Celebes I., which interests him especially, but in two maps the names thereabouts are not legible.

It has long been known that the geography of Drake's journeys in this voyage presents many difficulties, but as regards that part of it to South America and thence as far as California on the west coast, Mr. Wagner's work has gone far to settle practically all points, and where he differs in identifications from his predecessors, it may be fairly taken that he is right. When, however, he is dealing with the Pacific Ocean and the Malay Archipelago, the difficulties are of such a nature that the reader will do well to use his own judgment when comparing Mr. Wagner's views with those of others. There is here still plenty of room for argument.

Passing from the facts of Drake's great achievement, as stated in this latest examination of it, to the judgments expressed upon details, the situation is, however, on a different plane. Here the author pits his own mind against those of his predecessors, and despite the force with which Mr. Wagner's opinions are sometimes stated, the reader must here too use his own judgment. In the present writer's view he has not always appreciated Drake's difficulties, or projected himself sufficiently into the mind of a man of action of Drake's country and time. However, that again is a matter for argument.

It is not possible in a short notice of a great book like this—for it is a great book—to go into any of the very many points of geography, history, and human nature raised in it, and it must therefore suffice to assure students of

Drake and his period that they will find here a deep mine of information which may always be worked with profit. R. C. TEMPLE.

The Travels of Marco Polo the Venetian.— With an Introduction by John Masefield. London: J. M. Dent & Sons. 1926. 8 × 5½, pp. xviii. + 462. *Map and Illustrations.* 7s. 6d. net.

A handy version of Polo, better suited to the needs of the general public than the bulky volumes of Yule and Cordier, is certainly called for, and at first sight the present volume might be thought to supply the want. But a closer inspection leads only to disappointment. Although the book itself gives no information whatever as to the version adopted or the authorship of the extensive notes which appear on nearly every page, we soon discover that it is merely a reprint—on larger and thicker but otherwise inferior paper—of the version issued in 1908 as one of the volumes of "Everyman's Library." This in itself would be no ground for complaint, but unfortunately the "Everyman" edition was hardly suited to the needs of even the most uncritical public. It, too, made no definite statement as to the origin of the version used, incidental references in the notes to changes of Marsden's text being the only hint that this antiquated version (based on an inferior text and published in 1818!), together with the bulk of the original notes, had been followed almost word for word. Marsden's elucidation of the narrative was no doubt excellent for the time in which he wrote, but its reproduction at the present day with no attempt to correct or extend it from the exhaustive researches of later scholars leads to results little short of ludicrous, as when travellers or writers of the early nineteenth century are referred to as the most recent authorities—and this without a hint that the notes were not specially written for this edition. Many questions left unsolved by Marsden, but since fully elucidated by Yule, Cordier, and others, remain as problems still, while actual mistakes of identification are still uncorrected.

The intrinsic interest of the narrative is such that it will find readers in any form, but we cannot but regret that the substance of the present volume falls so far short of what might have been expected of publishers of repute. The illustrations, which did not appear in the "Everyman" issue, are attractive and well chosen, and are some set-off against the other drawbacks referred to.

GENERAL

Pursuing the Whale.— J. A. Cook. London: J. Murray. 1926. 9 × 6, pp. x. + 344. *Illustrations.* 18s. net.

A number of books on whaling have been published recently and have dealt mainly with sperm whaling or modern finner whaling. This volume by a whaling master of many years' experience treats chiefly of right or bowhead whaling in Alaskan waters, an occupation which is now practically extinct, but at one time employed several hundred American whaleships. Capt. Cook writes only of his personal experiences, and attempts no comprehensive history of American whaling in Arctic waters. In some respects that is a pity, since a history of this industry by a man who understands it is needed, just as a full history of English and Scottish whaling has still to be written. On the other hand, the book is all the more vivid for being an account of personal adventure. For several years, following the custom of American whalers, the author wintered at Herschel Island, and the stories of those winters are among the best chapters in the book. It was frequently no easy task to get enough fresh meat for all on board, or to keep restless crews in hand. No ship-master, however, was better suited than an American whaling skipper for facing and overcoming

difficulties: by usage and tradition he was schooled to lead and command. The lighter side of the whaler's life is seen in successful attempts to outwit harbour authorities and to deal with deserters. Some account is given of the actual whale hunts, but little is said about the whales and their habits, and something might have been added about the construction and peculiarities of build of the fine old ships engaged in whaling. Capt. Cook might no doubt have made more of the excellent material at his disposal, but he has produced a book that never fails to be informative and is generally interesting, though in places rather overburdened with details of ships' courses, weather, and ice-movements. There are many good illustrations, but the absence of any sort of map is a serious drawback in a book that deals with an out-of-the-way corner of the world.

R. N. R. B.

The Venturesome Voyages of Captain Voss. New edition. London: Martin Hopkinson & Co. 1926. $8\frac{1}{2} \times 6$, pp. xvi. + 326. *Illustrations and Maps.* 12s. 6d. net.

It is now many years since Captain Voss achieved fame by sailing from Victoria, B.C., to London *via* New Zealand, South Africa, and Brazil in a 3-ton yacht. His boat, the *Tilikum*, was an Indian cedar-wood dug-out, strengthened with oak frames and made more seaworthy by heightened bulwarks and the addition of a keel. She had a small cabin and a cock-pit for steering, and was rigged with three masts carrying four small fore-and-aft sails, giving a total spread of 230 square feet of canvas. The *Tilikum* was 38 feet long, and when loaded for sea with ballast and three months' stores, drew about 2 feet. Captain Voss and his mate, who was changed several times during the voyage, were the whole crew. It was certainly a venturesome voyage, but Captain Voss had many years' experience in small sealing vessels behind him, and he stoutly maintains that a small boat, if properly handled, is perfectly safe in any weather. In heavy seas he never attempted to run, but always hove-to under a riding sail and a sea-anchor. Thus he weathered many gales in comparative comfort and, in his opinion, safety. A number of technical points in seamanship are discussed in appendices to the story. In addition to the voyage of the *Tilikum* the book also recounts the shorter and earlier voyage of the 10-ton *Xora* from San Francisco to Cocos Island and Callao, and the short but thrilling voyage of the *Sea Queen* from Yokohama, during which the boat was dismasted and turned turtle during a typhoon, but nevertheless returned to port. The open-sea passages are the best parts of the book. Experiences ashore are occasionally amusing but generally trivial. The first edition was published in Yokohama in 1913, but has long been out of print.

R. N. R. B.

All Round the Mediterranean.— Warren H. Miller. London; New York D. Appleton & Co. 1926. $7\frac{1}{2} \times 5$, pp. 172. *Illustrations.* 5s. net.

This should be of great comfort to those setting out uneasily on the round trip of the Mediterranean. They will be assured that at most ports tugs will put them ashore, motors will be provided by the agencies, and it will be quite easy to "cover the principal sites in the time." And there is this book, handier if less exact than Baedeker, to tell them as much as they will probably want to know. The writer's historical notes appear confused in places, and there are also misprints, but Mr. Miller's enthusiasm is unbounded for what, in appreciation of the inheritance of Hellenic culture, he calls "Our Sea."

Collins' Explorer Series.— Edited by Sir Harry Johnston, G.C.M.G. The Old Navigators; The Old Explorers; 19th Century Explorers; Modern Travellers; Pathfinders of To-day; Trading Companies. London: Collins. [1926.] $7 \times 4\frac{1}{2}$. *Illustrations.* 1s. 6d. net each.

This series covers fairly comprehensively the history of exploration from the Age of Discovery to the beginning of this century in a number of interesting and simply written biographical sketches. It originally appeared some years ago, but the present issue has largely been re-written and brought up to date. As an introduction to the subject, they should be valuable, for though most emphasis is laid upon the incidents of voyage and journey, the general significance of each man's life-work is made clear. It is a little surprising, considering the total contribution of the Dutch to the knowledge of the globe, that no explorer of that nation is included. There are few sketch-maps, but numerous portraits.

The Largest Ships in the World.— V. S. Fellowes Wilson. London: Crosby Lockwood & Son. 1926. $10 \times 6\frac{1}{2}$, pp. xii.+226. *Illustrations.* 10s. 6d. net.

The landsman, after reading this book, should have few questions to put on the construction or navigation of the ocean liner. Its development from the *Great Eastern* to the *Majestic*, methods of building and launching, the latest application of scientific invention to secure the safety and comfort of the passengers, are all described. Nor is the human side of the business neglected. The highly eulogistic style of the author, at times rivalling that of an advertisement writer, detracts somewhat from the enjoyment of the book. The illustrations are profuse.

The Principles and Methods of the Teaching of Geography.— G. D. Tamaskar. Jubbulpore: K. L. Bhawe, [N.D.] $7\frac{1}{2} \times 5$, pp. 178. Rs. 1½.

The author is a teacher of geography in India who finds that existing books on the teaching of the subject are not adapted to the wants of his country, and are moreover not practical guides because they "begin their talk in the abstract and end it in the abstract." Only three books on scope and methods escape his criticism on the latter grounds. Mr. Tamaskar's essay is interesting, not for the new ideas it contains, since there are few, but because it shows a lively appreciation of modern geographical teaching, and is not oblivious of the pitfalls that beset the teacher. But there is no particular application to India or Indian needs except in the lists of books. We hope that the book will awake in other teachers in India the enthusiasm for geography which the author clearly has.

R. N. R. B.

Geography from the Air.— E. M. Sanders. London: T. Nelson & Sons. [1926.] $9\frac{1}{2} \times 7\frac{1}{2}$, pp. 63. *Illustrations and Maps.* 2s. 6d. net.

Miss Sanders has produced an introduction to map study of a novel kind. It consists of a number of photographs, most of them taken from aeroplanes, to each of which is attached a simple map or plan on a large scale and a short description of the main features of the topography. A few simpler exercises on each feature are added. The book should prove helpful in teaching young children to understand maps, and there is no attempt to use the maps as texts and read more from them than they show.

THE MONTHLY RECORD

THE SOCIETY

Medals and Awards, 1927.

HIS Majesty the King has approved the award of the Royal Medals as follows : The *Founder's Medal* to Major Kenneth Mason, M.C., R.E. (Survey of India), for his connection between the surveys of India and Russian Turkestan through the Pamirs in 1913 and his organization and conduct of the Shaks-gam Expedition of 1926; the *Patron's Medal* to Dr. Lauge Koch of Copenhagen for his very remarkable six years' exploration of northern Greenland. The Council have awarded the *Victoria Medal* to Col. Sir Charles Close, K.B.E., F.R.S., for his distinguished contributions to the advancement of the Science of Geography; the *Murchison Grant* to Mr. John Mathieson for his surveys of Spitsbergen and for his special studies during his long service with the Ordnance Survey in Scotland; the *Back Grant* to Capt. A. H. MacCarthy for his preparation and leadership of the ascent of Mount Logan, 1925; the *Cuthbert Peek Grant* to Mr. Francis Rodd to assist him in further exploration of the Sahara; the *Gill Memorial* to Mr. A. E. Young for his development of the mathematical theory of Map Projections.

EUROPE

The Hereford Earthquake of 1926.

Dr. Charles Davison gives some notes on the earthquake of 15 August 1926 in the April number of the *Geological Magazine*. It is of special interest to compare it with the strong Hereford earthquakes of 1863, 1868, and 1896, three of the four (1863, 1896, and 1926) having apparently originated in the same twin-foci, the epicentre of one lying near Hereford, that of the other near Ross. The principal shock in 1926 took place at 4.58 a.m. on August 15, the intensity being 7 of the Rossi-Forel scale. A sketch-map of the area affected shows the wide extent of the disturbance, the isoseismal line of intensity 5 running near Manchester, London, and Exeter, while that for intensity 4 runs north of York. Of the four Hereford earthquakes, the latest takes the third place for intensity, that of 1896 coming first. Throughout much of the disturbed area the shock consisted of two distinct parts, the average interval being 2.8 seconds. Dr. Davison concludes that the earthquakes both of 1926 and 1896 originated in the same deeply seated foci nearly below Hereford and Ross, though in 1926 the impulse in the Ross focus was much the stronger.

Agriculture in Kintyre.

A study of the distribution of agriculture in Kintyre by Mr. James M'Clement, which was awarded the Royal Scottish Geographical Society's silver medal in 1926, is reprinted in the Society's *Magazine* for January, 1927. The elevation of the peninsula, rising to 1500 feet, is considerably interrupted at one point only, the V-shaped plain known as the Laggan, with Campbeltown approximately at its apex. Apart from a discontinuous coastal strip, this constitutes the greater part of the lowland, only 12 per cent. of the area being below 100 feet, while about 50 per cent. lies above 540 feet. The Laggan has been recently covered by the sea, and a 100-feet raised beach may be traced almost continuously along the western coast. The transported soil of the Laggan is light loam, tending to sand: the hillsides are also covered with light soils, and peat occurs on the tops. With a mild and moist climate, Kintyre

is the seat of a considerable agricultural industry, though other conditions are not particularly favourable. The nearest railway is at Oban, 60 miles from Tarbert in the north, but there are daily steamer services to the Clyde. The development of agriculture is partly due to the influx of Lowlanders in the seventeenth century, encouraged by the Marquis of Argyll. They settled in the southern half, and reclaimed much land. In the nineteenth century, the profits to be obtained from sheep-raising hastened the depopulation of all but the best agricultural land, and the population declined from 20,000 in 1831 to 15,000 in 1871. The parishes arranged by density of population are Campbeltown (in which the Laggan is included) 5 per 100 acres; Southend 3, and the remaining three, 2 per 100 acres: this is also, as might be expected, the order by cultivated area, low-lying level ground, or alluvial soil. The east coast is especially barren, through its steeper slope, and bad communication. Much along the north-east and north-west coasts is covered with natural wood. Uncultivated areas on the plains, apart from woods, occur where the soil is unsuitable—peaty, as in the middle of the Laggan, or exceptionally sandy, as in the west of the Laggan and the Southend sea-board. In the south the hill slopes are cultivated up to 400 feet, elsewhere to 200 feet. The rotation of crops is a six-year one, of grain, roots, grain, hay, grass, and grass. In the Laggan, both grain crops may be barley; on the hills oats take its place. This form of agriculture favours the raising of cattle on the low-lying farms. Butter, cheese, and cream are exported, but not milk, nor meat to any extent. Sheep are raised extensively on the hills, and with pigs form the most important export. The local woollen industry came to an end in 1907. The proximity of the Clyde area, with its large population, has no doubt stimulated agriculture greatly. A note by Mr. A. Stevens, amplifying the term "dissected plateau," is added.

The Monts-Dores of Auvergne.

A phyto-geographic study of this massif (which includes the highest ground in France outside the Alps and Pyrenees), contributed to the *Revue de Géographie Alpine* (Tome 14, 1926, Fasc. 3) by M. A. Luquet, is of some interest to the geographer as well as the botanist as showing the influence of physical and climatic conditions on the vegetation, and its relationship to that of neighbouring districts. The group forms an ellipse with major axis of 40 km. The foundation consists of granite, with some metamorphic rocks dating from the Lower Carboniferous. In Secondary times it was cut down to a peneplain, but this was profoundly modified by the great volcanic activity of the Tertiary, and later by glacial action, which caused the formation of a large number of lakes, now seen as extensive peat-bogs. This complexity of structure and composition has had a marked effect on the vegetation, which varies extremely in different localities. Climatic conditions too show extreme contrasts. The eastern slopes, below 800 metres, are subject to the same conditions of light, temperature, and precipitation as the Limagne, with sub-continental, or even Mediterranean characters. Above 800 metres we find a region of cloud and mist, with most pronounced rainfall towards the west, and temperature means as on the coasts of Scandinavia. Above 1500 metres a thick snow-cap persists for six months of the year. All the main phytogeographical elements of the Central Massif occur, Mediterranean elements appearing on the eastern slopes, those of Central and Northern Europe in the mountains. But as oceanic conditions of climate predominate, the Atlantic element of the flora is of great importance. Man has greatly modified the original characters by

cutting down forests and substituting meadows and cultivation. But the rigour of the climate has induced the nomadic habit, and with eyes turned outwards to neighbouring regions he has been far from using the natural resources to best advantage, and wide expanses have been converted into barren heath-lands. In modern times energetic Government action has led to reforestation, and as the district has failed to retain its population, a reversion to primitive conditions is in progress. The bulk of the paper is devoted to a detailed description of the various plant-formations, the distribution of which is shown by colours on a large-scale map. The concluding paragraphs discuss the relationships with the flora of the Forez and Southern Cevennes, and emphasize the contrasts between the eastern and western versants. The paper is well illustrated by photographs.

Sand and Mud Banks off the Coast of Schleswig.

A detailed description of the northern part of the "Wattenmeer," which washes the western coast of Schleswig, is given by Mr. Thade Petersen in the *Geografisk Tidsskrift* for December 1926. It is written in Danish, but a German summary is appended and the text is illustrated by a sketch-map. Few coasts present so extensive a medley of islands, banks, and channels as that here in question. The firm coast of the mainland is fringed with a succession of islands permanently above high water, the largest north of Sylt being Römö and Fanö. In the ordinary small-scale maps a continuous belt of water is shown between these and the mainland, in places 10 or more kil. in width, but in reality the greater part of this belt is uncovered at low water, the wide banks (known locally as "Watten") being then traversed only by narrow branching channels or "deeps." By far the greater part of the banks consist of sand, yellow or grey on the surface, but often blackened at a slight depth by sulphate of iron. The most extensive mudbanks occur between Römö and the mainland, fringing the northern part of the island on its eastern side and also the opposite mainland coast near Ballum. Here the deposit of mud has made great progress within the past decade, apparently owing to the building of the Ballum dyke, which has resulted in a change in the mouth of the Brede Au. It is thought likely that in a few years this great mud-bank will form permanent marsh-land. The stratification of the sandbanks has not been carefully studied, but it is known that an old moorland surface with plant-remains exists in places below the Prussian datum level. The tide plays the most important part in moulding the features of this tract. Twice daily the sea invades the whole, but on its retreat it does not follow quite the same course as in its entry, the flood being earlier and stronger from the south than from the north. It is calculated that 700,000,000 cub. metres more water finds its way out each tide by the northern passage than has previously entered by this way.

Economic-historical Studies of Lüneburg and Magdeburg.

Some interesting factors in the development of a North German town are brought out in a paper on Lüneburg by F. Langenheim, contributed to the *Fahrbuch* of Hannover Geographical Society for 1926. It was said that it owed its importance to "mons, fons, pons"—the Kalkberg, which overtopped the surrounding diluvium, the mineral springs, and the bridge across the Ilmenau. Down to the eleventh century, the region along the river formed a frontier "mark" between Teutons and Slavs, and Lüneburg was prominent as a defensive position. Later its importance rested upon the salt deposits, and especially upon the town's situation on the trade routes of Northern

Germany. In this respect it succeeded to the rôle of Bardowitz. The main line of traffic in this area in mediæval times was the North Sea-Baltic coastal route: interrupted by the peninsula of Jutland it turned inland, having thus to cross the Elbe. The route from Bardowitz to Lauenburg, lying approximately along the dividing line (40-metre contour) between the lower Elbe plains and the hilly country of the Lüneburger Heide, thus became of great importance. At the same time the Ilmenau offered a good north and south route. When Lüneburg replaced Bardowitz its important export was salt for the Baltic herring trade. In course of time its position was challenged by the growth of Hamburg and Lübeck, but the precious "staple" right it had won, by which all trade from north to south, *e.g.* from Hamburg to Brunswick or Magdeburg, must pass through the town, gave it an advantage. The loss of this right, internal dissensions, competition in the salt trade, the losses of the Thirty Years' War, the development of the Elbe navigation, and the supremacy of Hamburg, all finally caused Lüneburg to sink into the background. It still remains an important centre in the railway network, being still on the connecting link between the industrial west and the east. Industrially, its salt deposits have become the foundation of chemical works, and its limestone for artificial manures, while its relations to Hamburg have enabled it to develop timber and iron industries dependent upon imports. Finally, the advance of agricultural methods has turned the formerly desolate Lüneburger Heide into a fertile area, for which Lüneburg has become the economic centre. The population has doubled in the last sixty years (1925, 30,000). The development of the "Siedlungsbild" is described in detail.

The same volume also contains a full analysis of the economic position of Magdeburg. To some extent its position is similar to that of Lüneburg, though on a greater scale. It is noted that a scheme of railway construction for Germany was drawn up which would have centred on Magdeburg, but the opposition of the smaller states held it up. From the artificial predominance which Berlin acquired later as this centre, Magdeburg has suffered economically.

ASIA

Research in the Persian Gulf.

Attention should be drawn here to a summary, largely bibliographical, of scientific research in the Persian Gulf, by Sir Arnold Wilson, extracted from the *Journal* of the Bombay Natural History Society, November 1926. The several sections, which include geographical surveys, marine and river surveys, geology and zoology, among others, are not rigidly confined to the Gulf, but also include many references on 'Iraq and Persia. This is the more necessary since, as Sir Arnold points out, there is no comprehensive work on the Gulf, and information must be sought in many scattered quarters. This essay was undertaken to show what remains to be done, as well as what has been achieved. On the Arabian coast, in Oman, Musandam, and the Hasa littoral, there is scope for exploratory surveys, and there are likewise gaps on the Persian side, for example in the Mamasani and Boir Ahmadi country. But the need there is for a systematic survey programme rather than for the opening up of new areas. The somewhat chequered history of the marine surveys is given in some detail: political conditions, and the actual loss of valuable survey material, often prevented rapid progress. As is pointed out in the note on meteorology, many observations have been collected by officials resident in the Gulf which have never been worked up. In archæology, botany, geology, and medicine, however, further research is greatly needed. Though Sir Arnold's paper is

not a systematic bibliography—frequently only the names of travellers and students are given—it forms a useful introduction, and should stimulate further efforts.

AMERICA

The Canadian Arctic.

The Report of the Royal Canadian Mounted Police for 1926, which we have received from Inspector C. D. La Nauze, contains much information about life in Arctic Canada, the condition of the native population, and game supplies, in addition to accounts of patrols. In the Eastern Arctic several long patrols were made. The establishment of the farthest north post on Bache peninsula was noted in the *Journal* for November 1926. Inspector Wilcox made a journey from Ponds Inlet down the east coast of Baffin Island to River Clyde and Home Bay. Among the natives he found much illness, mainly pneumonia, though no destitution thanks to the proximity of the caribou breeding-grounds. In his opinion the population of North Baffin Island will be wiped out in ten years, unless medical assistance is supplied. Similar reports were made from Bylot Island, from Port Burwell on the mainland near Cape Chidley, from Cumberland Gulf, and farther afield. It is noted that Eskimo were working outcrops of graphite on Blacklead Islands, Cumberland Gulf, from which 30 tons had been obtained. Two of the patrols recorded in detail describe exploratory work in South Baffin Land. In April 1925 Constable Tredgold left Pangnirtung, Cumberland Gulf, and joined Mr Soper, an American ornithologist, at the head of Nettilling fiord. Having taken a surf boat with them, they were able later in the season to follow round the southern and western shores of Lake Nettilling as far as Koukjuak river. The following year the same constable accompanied Sergt. Wright on a long and arduous journey, 1286 miles in all, from Pangnirtung across the interior to Lake Harbour on the south coast. The route lay by Nettilling Lake, Amadjuak river and lake, and Mingo lake, and thence by the shores of Hudson Strait. The weather was very cold and the going difficult: the country was largely unknown to the guides, the existing maps were faulty, and no natives or caribou were encountered. At one time their dogs had had no food for four days. On the return journey they were more fortunate. It is said that of 550 reindeer landed for stock purposes near Amadjuak in 1921, not one has survived. Another long patrol, 975 miles, was made by Staff-Sergt. Joy from Craig Harbour, Ellesmere Land, to Grethasoer Baý, on the west coast, and portions of the southern Axel Heiberg Land, by Goose, Baumann, and Troid Fiords. During his journey he came across records of the *Fram* expedition left in 1901-02. The ice conditions were good in general, and on the west coast he found the strongest growth of vegetation he had seen in the Arctic, and a region which must be teeming in game, including musk-ox, caribou, and bear. Another journey made by him opened up a route across North Devon Island to the post at Dundas Harbour. The remainder of the report deals with the Western Arctic, with the administration of the country, the preservation of game, the bringing of natives to justice, and the relief of tribes on the point of starvation. The Report shows to what an extent the Eskimo have come to depend for supplies and medical assistance upon the Police and the trading posts, though in general it is noted that the Eskimo who are not in close contact with trading posts, as for example those in the interior west of Chesterfield Inlet, are sturdier and more attractive.

Earthquake of 1925 in the St. Lawrence Valley.

In a note reprinted from the *Bulletin* of the National Research Council (No. 56, Washington, 1926), Mr. Noel J. Ogilvie shows the desirability of co-operation between geologists, geodesists, and seismographers, illustrated by a recent example. On 28 February 1925, a shock of a few seconds' duration was felt in the St. Lawrence valley coincident with a loud roar. Noises were heard as far west as Ottawa, and tremors continued for two weeks. The greatest damage to buildings was done near St. Pacome, Riviere Ouelle, Baie St. Paul, and Shawinigan Falls. Cracks appeared in the crust between Riviere Ouelle and Riviere du Loup, having a maximum length of 150 feet. In order to co-operate as far as circumstances permitted with the Dominion Observatory, a party from the Geodetic Survey releveled the 114 miles between Riviere du Loup and Levis. A graph is given of the deviations of the 1925 levels from those of 1915. To the Riviere Ouelle the differences can be accounted for by frost action or instrumental errors: thence a gradually increasing drop takes place, reading 0.37 foot at Montmagny. This decreases until at Levis the difference is approximately 0.1 foot. This area of greatest difference occurs in a trough with an average elevation of 35 feet between a 300-foot plateau and a plain of 100 feet elevation. It is noted that seismologists had previously concluded that the fault line had entered the south shore of the St. Lawrence at the Riviere Ouelle trough. If the actual bench marks are plotted, a rise in elevation is shown north-east of St. Pacome and a drop to the south-west. The mutual substantiation of seismological and geodetic conclusions shows the value of geodetic observations before and after earthquakes.

The Cliff-dwellers of South-West Colorado.

A detailed study of the human environment of the Mesa Verde area of South-West Colorado and its influence upon the "Cliff-dwellers" is contributed by Mr. William H. Haas to the *Annals* of the Association of American Geographers, vol. 16, 1926, No. 4. The Mesa Verde, a deeply dissected area of the Colorado plateau cut off by canyons and escarpments, was abandoned by the Cliff-dwellers before the coming of the white man. Mr. Haas emphasizes the fact that these Indians were not separate culturally from the other Indian peoples, but had merely adapted themselves to local conditions—nomadic Indians who perforce became sedentary. The Papagos of Arizona are given as an example of an opposite tendency, where a sedentary people became nomadic. The main cause of this differentiation was the nature of the food supply. In contrast to the Indians of the Plains or of the eastern woodlands, the inhabitants of the Mesa Verde were compelled to produce their own crops, the principal being maize. This required their presence at the proper time for sowing, and constant attention during growth. The character of the country rendering east-to-west travel almost impossible further confined them to limited isolated areas. The Mesa Verde, above average plateau elevation, ranges from 5000 to 8000 feet; the horizontal sandstone strata are broken in places by igneous projections, and particularly by the canyons: these are from 500 to 1000 feet in width, and the deepest are 1000 feet. In the walls of these the cliff-dwellings were built. The area is crossed from north-east to south-west by the Mancos, but in general the drainage is insignificant. The annual rainfall is below 20 inches, distributed very irregularly. The low relative humidity and the nature of the ground also produce the maximum erosion, and the least benefit to vegetation. The northern section carries oak brush and some excellent pasture, but in the more arid south, grasses are scanty, and

vegetation consists mainly of groves of pinyons and some stunted cedars. Under modern conditions, dry farming has been tried without conspicuous success, and the future appears to lie with ranching. Though some slight progressive desiccation may have taken place in historic times, it is difficult to account for the difference between the evident former population and the present. Possibly the advent of the Spaniards just tipped the scales in the Indian struggle for existence. Under the conditions, no individual independence was possible: a fact symbolized by the large communal houses. The necessity for storing water led to proficiency in ceramics, without the use of the wheel, and especially in irrigation. Considerable lengths of canals may still be traced in the river valley. In examining the question of population it must be remembered that crop yields far lower than the present economic limit would be sufficient for Indians, that they used comparatively little water, and that some of their articles of food would be disagreeable by modern standards.

The Desert Route through Southern Arizona.

An historical sketch of, and personal experiences along, a desert route in Southern Arizona is given by Mr. Godfrey Sykes in the *Geographical Review*, January 1927. The route, known as the "Camino del Diablo," follows approximately the United States-Mexico boundary for 160 miles from Sonoyta to the Colorado River at Yuma, across a particularly arid region. It is thought that Father Eusabius Kino was the first to use it in 1699, on his expedition from the Magdalena River settlements to the tribes of the lower Gila river. The dangerous nature of the crossing discouraged travellers until Spanish interest in this area developed towards the end of the eighteenth century. Father Garces followed it in 1772, and again in 1774 with de Anza's expedition. But the great impetus to its use was given by the discovery of gold in California in 1849, and to a lesser degree in 1860. A safe route, with certainty of water, existed along the Santa Cruz and Gila rivers, but as this meant a journey of nearly 400 miles as compared with 230 by the "Camino," the hasty gold seekers plunged, generally ill equipped, into the desert. Along the track there are but two permanent natural water basins, eroded in the rocks, and in 1860 a well was opened at Tule. Altogether hundreds are said to have died of thirst at various times. At present lack of water is less an obstacle to motor transport than the presence of sand-dunes, the difficulty of following the track, and mechanical breakdowns. It is not, however, greatly used now. Mr. Sykes gives examples of the effects of "desert thirst," and describes his own experience on a trip in 1925, with physiological notes. In two strenuous days, one of which included $4\frac{3}{4}$ hours' work at a temperature of 115° - 110° , making a track through sand-hills, he suffered a temporary loss of weight of 14 lbs.

AUSTRALASIA AND PACIFIC ISLANDS

Exploration in New Guinea.

We have received from the Lieut.-Governor of Papua some notes on an expedition recently despatched to North-West Papua. The leader is Mr. C. H. Karius, Assistant Resident Magistrate, who is accompanied by Mr. I. Champion, the remainder of the party consisting of two native N.C.O.'s and ten men. The party left Port Moresby at the end of last year. Their object was to ascend the Fly River to its source and then to gain the Sepik valley. They are then to attempt to reach the north coast by the Sepik, or, failing this, will return by their outward route. The Fly was to be ascended for 520 miles by boat, to Lario Bank, where the party, accompanied by carriers, were to land and work round east of the swamps to the headwaters of the Fly or Palmer. This is unexplored country: that to the west has been traversed by Mr. Leo

Austen (see *Geogr. Journ.*, 67, 434; the sketch-map shows the earlier stages of the journey). On reaching the Sepik, Mr. Karius intended to strike across the Victor Emmanuel Range and again reach the river lower down. If practicable, he would then proceed to Marienburg, on the north coast. Stores for five months were taken. A preliminary report has been received from Macrossan Island on the Fly River.

GENERAL

John Norden.

The acquisition by the Society in recent years of several excessively rare county maps by John Norden lends an interest to anything which can throw new light on the personality of their author. It has long been a matter of uncertainty whether John Norden, the surveyor and topographical writer, and John Norden, the religious writer, were one and the same person. In working at the 'Short-title Catalogue of English Books, 1475-1640,' Dr. A. W. Pollard was led to examine this question, and his paper, read last year at the Bibliographical Society and printed in *The Library*, December 1926, under the title "The Unity of John Norden: Surveyor and Religious Writer," practically sets it at rest. With one exception, none of the topographical or religious works appear after 1625. None of the religious works are sermons, so that their author was almost certainly a layman. The one book published after 1625, 'A Good Companion for a Christian' (1632), proves to be a posthumous work, and supplies a further link in the identification; for the dedication by the younger Norden states that "My deceased Father very oftē suruaied the Kings Lands." Other links can be obtained from a comparison of the two classes of works: thus 'A Pensiuē Mans Practise' is dedicated to Sir Henry Knivet, to whom Norden goes out of his way to make a reference in the MS. of his 'Survey of Middlesex.' Similarly 'A Sinfull Mans Solace' is dedicated to Sir Edmund Anderson, Lord Chief Justice, of whom there is also special mention in the 'Middlesex.' A supposed argument for the separate identity of the topographer and theologian had been derived from the discovery at Hatfield of a request from Norden for a pass to pursue his surveys, which stated, "I was by some unfortunatellie mistaken for another of my name," and it was thought that this might have been the religious writer; but whoever this second John Norden was, the above evidence points to the identity of topographer and moralist. Having established this, Dr. Pollard ingeniously shows, from the dates of publication, that whenever Norden was achieving success with his surveys there was a lull in the production of the religious works, which however came forth again whenever a cessation of his activity in the other field rendered his financial position less favourable.

The Tenth Italian Geographical Congress.

A general meeting of Italian geographers takes place every three years, and the tenth occurrence will be in the autumn of the present year, at Milan, from September 6 to 15. The programme of the meeting, a copy of which has been received at the Society, shows that especial attention will be given to economic problems now facing Italy as well as to the diffusion of culture and geographical knowledge. The organization follows the usual lines of such assemblies. The proceedings at Milan (September 6 to 10) will include both general and sectional meetings for the delivery of addresses and the reading of papers, while five exhibitions will be arranged for the same period, illustrating the expansion, scenery, and geographical output of Italy, as well as early cartography in general. Excursions will take place afterwards—to the Italian Lakes, the Upper Ossola valley, and the plain of Lombardy. Foreigners as well as

Italians are accepted as members of the Congress, the subscription being fixed at 40 lire for private persons and for learned institutions, and 100 lire for public bodies and societies of an economic character. The President is General Carlo Porro, and the office of the Organizing Committee is at the house of the Touring Club Italiano, 10 Corso Italia, Milan (105), to which inquiries may be addressed.

CORRESPONDENCE

Ancient Surveying Instruments

IN a paper on "Ancient Surveying Instruments" which I recently read before the Royal Geographical Society (see *Geogr. Journ.*, February 1927) I inadvertently omitted to say that the "groma" which was found in the Fayum, was first recognized at the rooms of the Egyptian Exploration Society by Mr. R. W. Sloley, who figured it and published an account of it in 'Ancient Egypt,' September 1926. This, together with the information contributed by the President to the discussion on the paper, completes, I think, all that is known about this interesting instrument.

H. G. LYONS.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

Tenth Evening Meeting : 21 March 1927.—The President in the Chair.

ELECTIONS.—Edmund Chaplin Baldwin, O.B.E., F.C.A., F.C.I.S., F.F.I., Bentley Beetham; Percy George Frederick Clarke, M.A.; Charles Thorpe England; Alfred Reinhold Tanner Finch, B.A.; Henry William Hall; Capt. Frederick Henry Miller; Chadwick H. Moore; Lieut. R. D. Neville, R.A.; George Normanton; Capt. Vivian Gerald Olive; Frederick Charles Penney; Emile Victor Rieu; John Charles Edward Rogers; J. A. E. Sanders-Bates, F.R.A.I.; Kumud Bandhu Sengupta, B.A., B.T.; Mrs. M. Sherlock; Frederick Burgess Smith; R. G. Ranyard West, M.B., B.S., M.R.C.P., D.P.H.; William Croucher West; T. A. Williams; David Wynter.

PAPER: The Cambridge Expedition to East Greenland. Mr. J. M. Wordie.

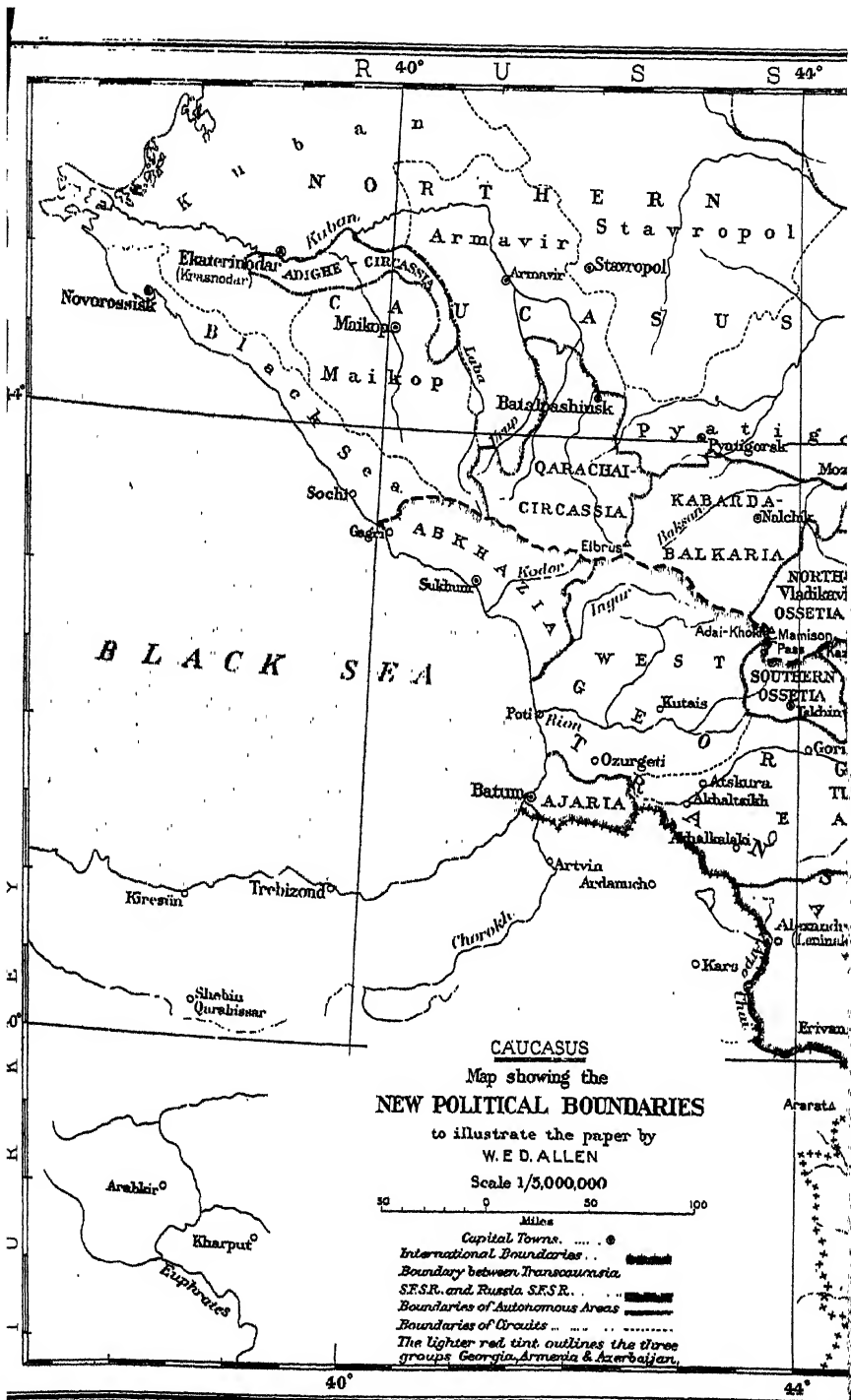
Sixth Afternoon Meeting : 28 March 1927.—Sir Charles Close, K.B.E. (Vice-President), in the Chair.

PAPER: A graphical method of discussing the Figure of the Earth. Mr. A. R. Hinks.

Eleventh Evening Meeting : 4 April 1927.—The President in the Chair.

ELECTIONS: Newton Bell; Capt. Alfred Boyes; Ellis Lee Entwistle; Bernard Greaves; George Alexander Greville Haslam, B.S., M.A.; Ernest Housden Langley; E. S. Lindley, B.A., M.I.C.E.; Alan Moysey-Adams; Major M. A. Nicholson, M.B., I.M.S.; William George Phillips, B.A.; The Hon. Charles Rhys, M.P., M.C.; Sir John C. E. Shelley-Rolls, Bart.; Capt. Claud Slaughter, R.A.M.C.; Mrs. Dora Gertrude Tapply; Lt.-Col. Louis Tebbutt, D.L., T.D., J.P.; Denton Thompson; William Gosseling Trower; Hadwen Harry Williams.

PAPER: Miss Gertrude Bell's Journey to Hayil. Dr. D. G. Hogarth (President).



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June 1927

SOME CONTRASTS IN NIGERIA

The Rt. Hon. W. G. A. Ormsby-Gore, M.P.

Read at the Meeting of the Society, 7 March 1927.

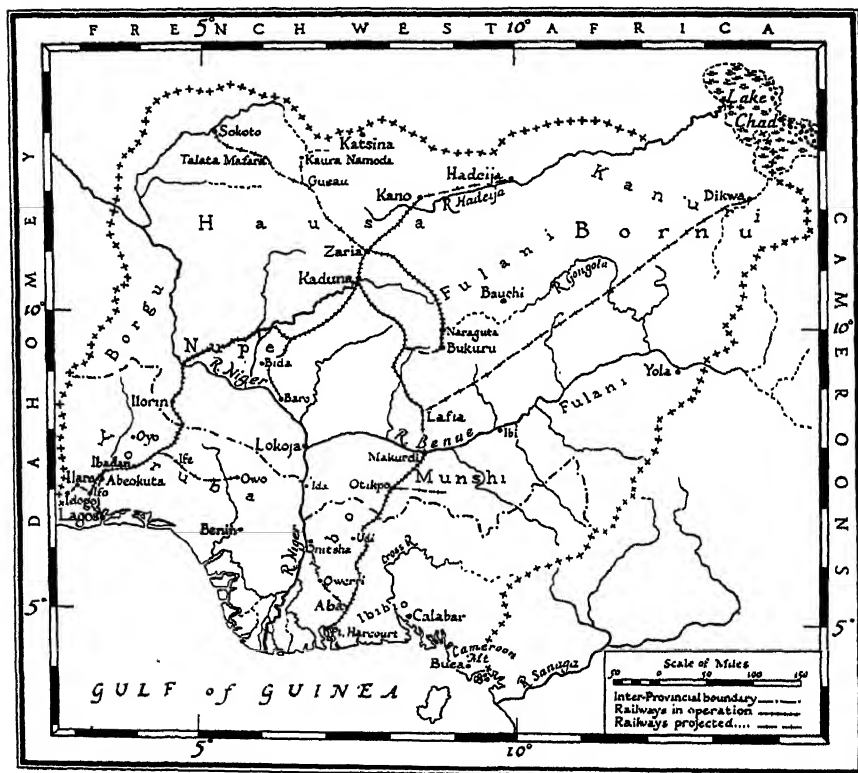
EARLY last year I spent some six weeks in Nigeria; a fortnight was taken up by conferences in Lagos, and a month by a hasty tour throughout the country. This tour included visits to the following places: Abeokuta, Ibadan, Oyo, Ilorin, and Benin in the south-west; Onitsha, Owerri, Port Harcourt, Calabar, Udi, and Makurdi in the south-east; the Bauchi plateau, Kano, Katsina, Sokoto, Zaria, and Kaduna in the north. So rapidly did I cover the ground that I fear any observations must necessarily be superficial. I have endeavoured to check my statements wherever possible by reference to two recently published works on Nigeria, which are clearly of the utmost value. These are, first, the two-volume book on 'The Northern Tribes of Nigeria,' by C. K. Meek, published by the Oxford University Press in 1925; and second, 'The Peoples of Southern Nigeria,' in four volumes, by P. A. Talbot, published by the Oxford University Press in 1926.

Nigeria is a very large country, rather more than seven times the size of England. It is the most populous of all British dependencies other than India, containing as it does approximately 20 million people. Of this 20 million there are between 4000 and 5000 Europeans, none of them permanently resident in the country, a few hundred Syrians who engage in trade, and the whole of the rest are Africans of the most varied description.

The first and most obvious contrast in Nigeria is that between the comparatively narrow southern belt, subject to extremely high rainfall widely distributed throughout the year and consequent excessive humidity, as against the much larger area to the north which is, generally speaking, hot and dry, with an average rainfall of between 20 and 60 inches confined to a clearly marked wet season in the summer months. This climatic line between these two contrasted areas runs slightly to the south of the line which separates administratively the provinces grouped under the Lieutenant-Governors of the Northern and Southern Provinces respectively. The reason for the existing political boundary between the

two groups of Provinces is mainly historic. Prior to 1900 there was the Colony of Lagos and Protectorate of Southern Nigeria, while all the country to the north was that over which the Niger Company had or claimed various rights. This division has continued, but it is not a natural boundary, either physical, climatic, or ethnographic.

The southern belt is uniformly low-lying except at its eastern extremity, along the Cameroons border. It is a country densely clad in natural forest, the most distinguishing feature of which is the prevalence of the



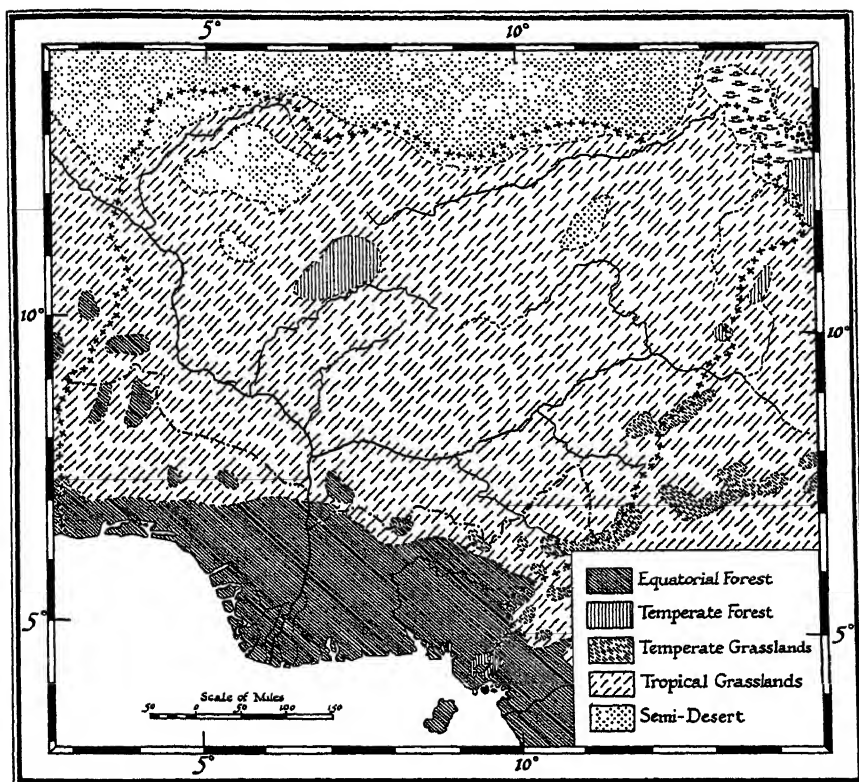
Sketch-map of Nigeria

oil palm that still constitutes the principal source of wealth and commerce of the whole country.

The larger northern area is for the most part also low-lying, though its general elevation is perceptibly higher than that of the Southern Provinces. In the centre there is the so-called Bauchi plateau, an open and practically treeless country running up to a maximum elevation of about 4000 feet. In the north-west there is higher country round Kaduna running up to an elevation of 2500 feet, where the rainfall is greater than elsewhere in the Northern Provinces, and where the country is for the most part clad by fairly dense bush, including trees up to 30 or 40 feet

in height. Much of Northern Nigeria is either open country or covered with low scrub. The main causes of the differentiation between the natural vegetation of north and south would seem to be the varying quantities and distribution of rainfall.

Man has necessarily been affected in his character and habits by the contrasted environment so produced, but it would seem that the main contrasts which are obvious to any casual visitor to Nigeria are the result not so much of these climatic contrasts as of man himself. The main



The Vegetation of Nigeria

contrasts are the contrasts brought about by different racial types and civilizations, and it is with these that I wish to deal more particularly.

I am conscious that I shall have to paint the picture with an extremely broad brush, and that such treatment necessarily conflicts with scientific accuracy in detail. Practically everything which I shall say, therefore, will have to be qualified by the words "broadly speaking."

The first contrast apparent in my tour was the very marked one between south-western Nigeria and south-eastern Nigeria, the river Niger being roughly the dividing line.

The Southern Provinces contain approximately 9 million people.

All are negroes, the immense majority of whom are pagans, with a fair-sized Christian minority. Very few are Muhammadans. The use of the word "pagan" is, of course, unscientific, and covers a great variety of indigenous African religions, most of which, if not all, can be better described as animist.

South-western Nigeria may be described as Yorubaland, though the people of Benin who are included in this area are usually called Edos. The Edos are very similar to the Yorubas, who dominate throughout the rest of the area. The Yorubas and their kinsmen the Edos are Sudanic negroes. They almost certainly migrated to Nigeria some time during the early part of the first millennium before Christ. They came from the north-east and were, from the time of their first arrival, users of iron. When they came their arts and agriculture seem to have been dominantly affected by ancient Egypt. Their first capital was Ife, and Ife remains to-day the principal religious centre of Yorubaland. The evidence for these statements is set out in Talbot's book.

The political derivatives from Ife were in the main two, namely, Oyo and Benin. The monarchical dynasty of Oyo, formerly paramount over the greater part of the hinterland, is of very ancient date, and the Alafin of Oyo is still the biggest chief of Yorubaland. The other derivative, Benin, appears to have broken away round about the year 1000 A.D. and became, at the height of its power in the beginning of the seventeenth century, the principal if not the sole authority along the coast between Dahomey and the mouth of the Niger, paramount over all the country between the dominions of the Alafin of Oyo and the sea.

The highly organized and complex Yoruba states are among the most interesting examples of negro civilization. They have undergone comparatively little change in type throughout the centuries, and the glimpses we get of them from the early European travellers following the first Portuguese arrivals in the second half of the fifteenth century are still visible to-day. In 1601 a Dutchman named de Bry described the straight streets of the city of Benin and the houses standing in good order. In 1668 another Dutchman, Dapper, who also visited Benin, stated that the town had thirty quite straight streets about 120 feet wide, with well-built houses in good order, decorated with gables. The King's compound he described as as big as the town of Haarlem, containing large square courts surrounded by galleries as big as the Exchange of Amsterdam. He noted the metalwork, especially the copper reliefs depicting deeds of battle. The city of Benin is still surrounded by the wall and deep ditch, some 9 miles in circumference, and formerly had a very much larger population than it possesses to-day. The houses are still well built, in good order, the streets wide, and the courts of the King's compound are as described 250 years ago.

The great towns of Yorubaland seem always to have been characteristic, and there are to-day no less than nine cities in Yorubaland (Benin



Phot. C. Rhys

The Alafin of Oyo



Phot. C. Rhys

Yorubas at Oyo



Hausa Horsemen

Phot. C. Rhys



The Lower Niger

Phot. C. H. Foulkes

is not one of them) that have more than 40,000 inhabitants. One of them, Ibadan, is a native-built city with nearly a quarter of a million inhabitants. One of the remarkable features of Yorubaland is the fact that the bulk of these town dwellers are agriculturists who live in the town but farm holdings often situated at a distance of some miles from their homes.

From an early date, therefore, the Yorubas have had a large urbanized population, skilled not only in agriculture but in many arts and crafts, such as stone carving, metalwork, building, and weaving; but their outstanding characteristic has been their theocratic monarchies. Fundamentally the Yoruba religion is really the worship of the apotheosized heroes of the original migration. Shango, the principal warrior in that event, has become the Lightning God. But important though these religious beliefs are, they are somewhat overshadowed by the sacred and almost deified position that they give to their great chiefs. This gives to the chiefs a spiritual as well as a political and judicial authority over their people which it is hard to overestimate. This spiritual authority possessed by the ruling chiefs, the Alafin of Oyo, the Oni of Ife, and the Oba of Benin, is intimately bound up with the supreme importance of ancestor worship. It would seem that the dominating idea is the influence for good or evil over the whole people of the spirit of a deceased paramount chief, and the position of the Oba of Benin has for centuries been what it has owing to his unique relation to the almost all-powerful spirit of his predecessor.

The chief characteristic in Yorubaland of the worship of gods or deceased spirits is sacrifice, the offering of food and lives, and throughout Yorubaland human sacrifice in the past has been an all too prevalent feature of this worship. It would seem, too, that in Yorubaland, as in ancient Egypt, kingship has possessed a unique significance. Not only are sacrifices, including human sacrifices, paid to the spirit of the deceased king, but there were buried with him wives, slaves, children, and all the articles of daily life and work which his spirit would require in the spirit world, conceived very much as a continuance of life in the present world. Cannibalism, however, seems never to have been known among the Yorubas.

Deriving from religious ideas connected with the position of the chief, the Yorubas have been able to evolve an effective centralized machinery of government over large areas. The autocratic power of the chief when alive was always mitigated by the hierarchy of nobles and functionaries, each with their well-established customary rights. The basis of their society, whether in the supreme office or minor offices, is hereditary, and the basis of property seems always to have been hereditary in the male line.

The Yorubas have always been mainly an agricultural people, and practically all the agricultural work has been done by the men and not

the women. This fact seems to be one of the contrasts between the custom of the Sudanic negroes and that of the Bantu or so-called semi-Bantu, of whom more anon.

The main staple food of Yorubaland is the yam, a large starchy tuber developing on a vine. Yams, together with peppers, palm oil, and fish, form the main basis of subsistence, while game is hunted and eaten; but for many years past, owing to the tsetse fly, it would appear that the number of domestic animals—a few small black goats—in the towns and villages have been few and far between. That this was not always the case it may be noted in passing, for we have a record of the year 1601 that the Oba of Benin had a considerable quantity of cavalry, which would seem to point either to the absence of tsetse fly or to its non-infection at that date. To-day no horse can live in Benin.

The Yorubas built their houses entirely of solid mud without the aid of a stick framework. They were always rectangular in shape and similar in lay-out to that of ancient Egypt. The most representative collection of the arts of the people of south-western Nigeria is the collection of Benin bronzes and sculpture in the British Museum.

On crossing the Niger we find, to quote the words of Talbot, "the population is composed of peoples living in independent, unconsolidated, and usually small groups, subject to no central government." In south-eastern Nigeria, which is far more densely populated than south-western Nigeria, we have immediately along the left bank of the Niger a very numerous people (over 3 millions) called the Ibos. The Ibos, like the Yorubas, speak a Sudanic language, but beyond this fact and their universal cultivation of the yam, they are singularly different from the Yorubas. The Ibo is smaller and more backward in every way than his western neighbour. There is none of the aristocratic or theocratic social organization. They are less skilful as traders or craftsmen, slower to adapt themselves to new ideas. It is remarkable to see the activity of the new Yoruba colony springing up at Port Harcourt in contrast to the more primitive and less progressive Ibos of the district.

East again of the Ibos in the provinces of Calabar, Ogoja, and Munshi, we enter another new world where the inhabitants consist of a number of different tribes known collectively as semi-Bantu. I always think the word "semi-Bantu" is most misleading. It would suggest a people whose language is half Bantu and half something else. It is, of course, nothing of the kind. The better word would be "proto-Bantu," as probably the more correct notion is that the Bantu languages of East and South Africa contain and have evolved from roots which are discoverable in the more primitive so-called semi-Bantu languages. "Semi-Bantu" would seem more applicable to the language of a tribe like the Nagumi who inhabit the Benue valley, 42 per cent. of whose words are Bantu and 53 per cent. Sudanic.

The peoples of the eastern part of Southern Nigeria, and the pagans

of the Bauchi plateau in Northern Nigeria, are collectively all classed as semi-Bantu. They are almost certainly the relics of the original indigenous inhabitants of Nigeria before the immigration of the Sudanic peoples, and of the others who followed them, of whom I shall speak in connection with the Northern Provinces.

One of the chief characteristics of all these proto-Bantus, whether in Northern or Southern Nigeria, is their addiction to cannibalism. Cannibalism is practically unknown among the Sudanic tribes.

It is perhaps unfortunate that the most numerous of proto-Bantu tribes in south-eastern Nigeria should be called the Ibibios, which to the layman sounds all too like Ibos, the name of their neighbours. A traveller to Calabar in 1789 would seem to have got hold of a better orthography. He wrote, "The Ibbibby are much disliked by the Heebo, and are called by them cannibals. They (the Ibbibby) file their teeth so as to look like a saw, and they are always the ringleaders of any mutiny on board ship."

I said just now that these people may be the aboriginal possessors of the country—they are certainly very much lower in civilization. On the Bauchi plateau they are still for the most part naked, and among the proto-Bantus in south-eastern Nigeria the introduction of clothing has for the most part only followed contact with European commerce.

There are in south-eastern Nigeria, in the Cross river basin, the remains of stone circles, menhirs, and even, it is alleged, dolmens, which show that at one time the great heliolithic culture which we in England associate with Stonehenge once obtained in south-eastern Nigeria. I know of no photographs of these monuments, and only a few of them seem to have been seen by Talbot. Their further investigation should prove of great interest.

These stone remains are still of course regarded with superstitious reverence by the local natives, but it is doubtful whether they have any remnant of the characteristics of the heliolithic culture or any valuable traditions concerning the origin of the monuments. They certainly have no knowledge of its arts and crafts or of the working of stone.

The bulk of the proto-Bantu tribes of Northern and Southern Nigeria build round houses as opposed to the rectangular houses of the Sudanic negroes. The Ibibios, however, have evidently learnt the rectangular form of construction from their Ibo neighbours, but in contrast to the Yorubas the Ibibios build their houses by plastering mud on a stick and leaf framework, a practice dispensed with by the Yorubas.

There are no towns in south-eastern Nigeria except those that have sprung up on the coast, as the result of the coming of Europeans. East of the Niger both Sudanic negroes and proto-Bantus live in small villages, seldom more than a few families together, the site of which is continuously moved with the shifting cultivation that is practised.

Among the proto-Bantus men clear the forest by cutting and burning

the trees, and the women do the agricultural work. It is doubtful whether at any time before the coming of the British they had any cohesion whatever. Efforts are, however, now being made to endeavour to ascertain whether there is any tradition of a clan organization superior to the individual village, and in some cases—but these are so far few—it has been possible to identify a claim of descent from a common traditional ancestor. But in many cases even this is lost. In this area, therefore, the creation of any system of native administration at all comparable to that operating in the highly organized Yoruba states or in Northern Nigeria is an extremely difficult task.

The religion of the proto-Bantus of south-eastern Nigeria would seem generally to include the worship of the supreme male god of the sky and his inferior consort the earth goddess, coupled with the cult of earth and particularly water spirits. To spirits are attributed the fertility or non-fertility of man, animals, and crops. The propitiation of these spirits by offerings seems to be general. The chiefs have little or no spiritual authority. Priestesses of local cults are a feature. Ancestor worship on animist lines is general, but has few of the characteristics of the special importance of the spirits of deceased chiefs so noticeable in Yorubaland.

Before leaving Southern Nigeria I should mention that the Portuguese introduced, mainly from the New World, new economic products which supplemented the original universal native foods of yam, pepper, palm oil, and fish. The principal things introduced by the Portuguese were cassava, maize, oranges, pawpaw, tobacco, turkeys, and the muscovy duck, all of which have become part of the economy of the southern tribes. Cassava, in particular, which we know was an important staple food of the Arawak and other South and Central American Indians, though slow in taking hold, has now become an extensively planted crop, particularly in south-eastern Nigeria.

It is frequently asserted that the peculiar arts of Benin—casting in bronze, etc., were introduced by the Portuguese. I think there is now no doubt that both the methods and motives can be traced back both at Benin and still more at Ife to periods long anterior to the Portuguese arrival.

Northern Nigeria is far more extensive than Southern, and would seem to have been subjected to more external influences than the negro land proper of the south. We find there the extremely primitive proto-Bantus, now mainly driven up into the Bauchi highlands. We also find fairly large bodies of Sudanic invaders. Time was when one of these Sudanic tribes, namely the Jukuns, a people very similar to the Yorubas, having most of their characteristics, had widely extended domains. The Jukuns, whose centres were in the Benue valley, in the year 1600 captured the city of Kano and ruled most of the Northern Provinces. Nowadays, the Jukuns are a small and not very important tribe.

West of the Jukuns another important people of Sudanic origin, the Nupes, were remarkable for their metal craft. Bida is their centre and in that place their traditional skill in this art is still maintained.

But all this is history, and the dominant peoples of Northern Nigeria to-day are the Muhammadans who for the most part are not pure negroes, and in some cases are not negroes at all. There are to-day in Northern Nigeria at least 5 million people who speak Hausa. Hausa is neither proto-Bantu nor Sudanic but Hamitic, variously enriched by Semitic influences, the latter, I suggest, having come in with and subsequent to the rise of Islam. Of the 11 million people of the Northern Provinces approximately 70 per cent. are Muhammadan.

The Hausas are a nation and not a tribe. They are of very mixed blood. They have a lot of Sudanic negro in them, but the mixture of blood is still a problem. This mixture appears to have come from three directions: first, down the Niger, ultimately from Morocco; secondly, across the Sahara from the Berbers and Libyans of the South Mediterranean; and thirdly, from the east *via* Lake Chad. First the Hamites, and then the Arabs.

Still the Hausas with their long robes and large turbans, their well-built if squalid and congested towns, their genius for trading and their cereal cultivation, are to-day a nation with common characteristics of a very definite kind. They form the vast mass of the population of north-western Nigeria. The force that has welded them and made them a nation is undoubtedly Islam.

North-eastern Nigeria, commonly known as the Empire of Bornu, is non-Hausa and very different, except in religious belief. Time was when the Hausas were organized in cities and states of their own, of which it would seem that Kano was always the most populous and most important from an economic point of view, as the chief market of the western Sudan since the fall of Timbuktu, and possibly before that. But to-day all the Hausa states, and some others, such as the Yorubas of Ilorin and the Nupes, are under the rule of Fulani Emirates.

Who are the Fulani? Nobody appears quite to know. They are a long, comparatively straight-haired people, and an occasional pure Fulani girl will have hair down to her waist. Though dark they are definitely non-negro. They are still for the most part nomads, their principal occupation being the herding of cattle and sheep. Their cattle are humped like the Indian ox. There are two main breeds: a white or flea-bitten grey cattle with or without black points is the most characteristic. The indigenous cattle of Nigeria, still found in small numbers in Southern Nigeria, particularly in the Provinces of Ogoja and Benin, are a very small dark non-humped variety, apparently immune from tsetse-borne diseases. None of the Fulani cattle are so immune. There are to-day some three million head of the large humped types of cattle in the four Northern Provinces of Sokoto, Kano, Bauchi, and

Bornu. Their numbers have diminished even in recent times owing to the spread of rinderpest and trypanosomiasis, the two most urgent problems facing the veterinary staff in Nigeria.

The Fulani entered Nigeria from the north-west and are identifiable with the Foulahs of the Gambia. Just about a hundred years ago they threw up a great religious leader, Othman-Ibn-Fodio, who preached a Muhammadan religious revival which he fortified with a Jihad. He became the Sultan of Sokoto with the title of Seriki Muslimi (Lord of all Moslems) and he and his followers conquered all the Hausa states, the Yoruba state of Ilorin, and then carried their power south of the Benue to Yola in south-eastern Nigeria on the border of the Cameroons. Fulani rulers, not only Emirs but Wasiri and Alkalis (judges), etc., were set up by him in all the Hausa states, all nominally under Sokoto.

The history of Northern Nigeria from the death of Othman-Ibn-Fodio to the coming of Sir Frederick Lugard is the history of the re-establishment of the independence of all these states under their Fulani governors as separate sovereign powers. But as late as 1894 the annual tribute to Sokoto from the city of Kano was 100 slaves, 100 horses, 1500 robes, 10,000 turbans, and other similar articles.

Throughout the Fulani Empire the law of personal property is the Sheria law, but real property, *i.e.* land, is still governed by the old customary law of Sudanic times.

The Hausa states were nominally Muhammadan before the revival of a hundred years ago, but up till then this Muhammadanism was somewhat superficial, and many of the old pagan beliefs still obtained. The Koran had become their chief fetish, but little more. At the time of the Fulani conquest the Hausa states were in a condition of political decay, and it would seem that the various dynastic revolutions effected by Othman were effected with remarkable ease. To-day Islam is the outstanding and dominating feature of their civilization.

This has its good and its bad side. Its good side is admirably summed up by Mr. Meek in the work to which I have referred above. He writes : "Islam has brought civilization to barbarous tribes. It has converted isolated pagan groups into organized nations. It has broadened the outlook, raised the standard of living by creating a higher social atmosphere, and has conferred on its followers dignity, self-respect, and respect for others. The intellectual and political superiority of the Moslem communities is chiefly due to their religion. Islam introduced the art of reading and writing, and by the vista of a wider world enabled progress to take place."

On the other side of the picture stands first and foremost slavery. Until the British conquest slavery was the basis of everything in Northern Nigeria. Slave raiding, slave trading, and slave owning seem to have been intensified as a result of Fulani ascendancy, and during the last hundred years this process has probably diminished vastly the numbers

the pagan population of Northern Nigeria. Some parts of the country almost depopulated to-day as the result of the slavery activities of, one case, an Emir who is still alive.

Whatever we may think of Muhammadanism we cannot get away from the fact that in Northern Nigeria Muhammadanism is tenaciously held and is an all-important formative force in shaping the social and political institutions of the great majority of the people. Whatever may have been the tribal or other concepts governing life in the past, they are altogether overshadowed to-day by the teaching of Islam, which is not merely as a religious opinion, but as a system of social order.

Life in Hausaland is predominantly agricultural, and the distribution of the population has been dictated very largely by the agricultural requirements. Owing to the long dry season human habitation has been concentrated in towns and villages along the rivers, from whose beds it is possible to draw water in the dry season, when the rivers have ceased to flow above ground. The main agricultural work takes place in the brief wet season, and is therefore mainly rain cultivation, though in some places primitive irrigation is understood by means of the Egyptian shadouf.

In north-western Nigeria there are comparatively few permanently constructed wells. In north-eastern Nigeria (Bornu), on the other hand, the art of well-sinking to considerable depths has long been known and practised.

In Hausaland all agricultural work is done with the hand hoe, also of the Egyptian type. The main food crop is sorghum, commonly called Guinea corn. Cotton has also been cultivated for centuries for local weaving, and now for export. As is well known, ground-nuts have become an important crop, particularly in the economic radius of Kano. The Hausa method of cultivation is by regular ridge and furrow, in contrast with the heap or mound cultivation of the Yorubas and the treeless cultivation of Bornu. The Yoruba mound cultivation seems to have been dictated mainly by the requirements of the yam.

In Bornu the main food crop is bulrush millet, and instead of using the Egyptian hoe with its haft at an angle, the people of Bornu use a straight hoe with a sharp point, simply poking the millet seed into the hard soil. The Kanuri of Bornu seem to prefer using the light land, while the Hausas prefer the heavier soils.

In Hausaland, particularly where the population is dense, as around Kano, cultivation has long been continuous, from year to year, and consequently there is considerable knowledge both of the principle of rotation of crops and of manuring. It is an old custom of the Hausa cultivator to attract the Fulani herdsmen with their cattle on to their land at certain seasons of the year, mainly for the purpose of obtaining the manure.

Trade and transport is only carried on in the dry season. Until our arrival there were no roads, only rough caravan routes, and all transport was done by head carriage or pack-animals. The donkey, the ox, and

the camel were all pressed into this service, and every year considerable numbers of transport drivers with their animals still enter Nigeria from French country to the north for the purpose of earning money with their transport animals.

One of the characteristics of the Hausas is their skill in weaving and dyeing. The dyes employed are indigo, which they grow locally, and the famous red dye so familiar on Nigerian goatskins, which is prepared from the outside sheath of guinea-corn stalks.

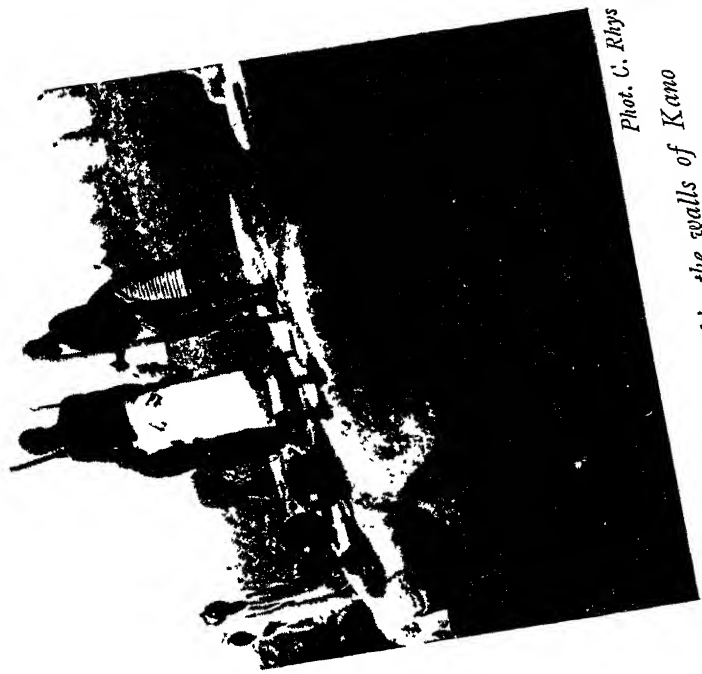
The system of taxation which obtains in Hausaland to-day would seem to be of extreme antiquity. Kano chronicles record that even in the thirteenth century one-eighth of the crop was collected from husbandmen, and that jangali, or direct cattle tax, is recorded in the reign of Kutumbi (1638-1648). In the old days most of the taxes were paid in kind, though cowrie shells were widely used as currency. The use of cowries as a medium of exchange still obtains in the market at Sokoto.

Few things strike the casual visitor to Hausaland more than the carrying of a short two-edged sword. This weapon, Roman in type, is seen on most of the transport drivers along the roads. It would seem to be the characteristic weapon of the country.

This reference to weapons leads me readily to the primitive pagans of the Bauchi plateau. These pagans are expert bowmen, and their survival is probably due in the main to their skilful use of the poison arrow. They live for the most part in small huddled villages in defensible places among the hilltops. Wherever possible they plant a stockade of cactus or euphorbia hedges round their settlements. These stockades frequently constitute a formidable labyrinth, and the bringing of these people under administration has been a difficult task. The Hausas build rectangular, the pagans round, buildings.

There is an amazing multiplicity of these pagan tribes, with a corresponding multiplicity of languages which seem to have little or nothing in common with each other. Their standard of civilization is extremely low. Some of them practise circumcision, others do not. Those that practise circumcision would appear to be rather more developed than those that do not. Weapon fetishes are a fairly common feature of their religious cults, and nearly all the tribes practise initiation ceremonies at adolescence. Witchcraft is of course a feature. Their knowledge of agriculture is of the most elementary order, and their principal food crop is the *Digitaria exilis*, locally known as acha, a poor form of cereal peculiar to these people, grown sometimes broadcast and more rarely in terraces. Not only is this grain their staple food, but it forms the material for the manufacture of their cherished beer. The pagans of the Bauchi plateau are great beer-drinkers, and their resistance to the spread of Muhammadanism is not a little due to their apparently all-pervading love of beer.

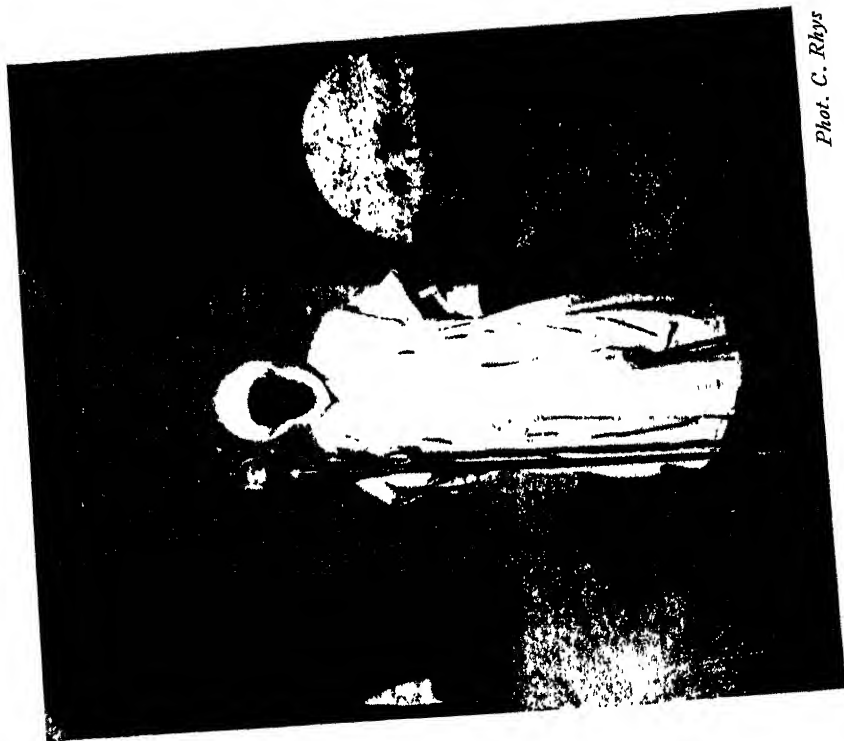
To the casual observer they would appear to be a cheerful child-like



Phot. C. Rhys
Dyeing Pits within the walls of Kano



Phot. C. Rhys
Entrance to Palace, Kano



Phot. C. Rhys

The Emir of Katina



Phot. C. Rhys

The Emir of Sokoto

people, clotheless and with few wants. They are however easily roused, and when roused become very fierce. Head-hunting was one of their characteristics, and formerly no young man was fitted to become a recognized bridegroom until he had killed his man and brought in the head. It is perhaps natural that the hand of their neighbours was always against them, and formerly whenever they were caught they were enslaved. To-day, however, they are becoming rapidly more peaceful and accessible, and it is astonishing to see them working in thousands in the tin-fields of the plateau. They still practise cannibalism, casual as well as ceremonial, and it will be a long time before it will be possible to induce them to abandon this practice.

My personal belief is that West Africa will accommodate itself fairly happily to the economic changes provided we proceed very cautiously over political and judicial changes. To my mind the most disintegrating force operating in West Africa is the introduction of English law and English judicial procedure in lieu of long-established native law and custom. Nothing tends more to undermine native traditions, society, and organization than the substitution of European for native legal forms. In fact, I hold strongly that the undoubted success of our administration in Northern Nigeria is in the main due to our having interfered as little as possible with the native judicial system.

As far as British administration is concerned Nigeria has become the *locus classicus* of the principle of "indirect" rule. From the very commencement of our rule in Northern Nigeria we have governed the country through the Emirates and their organized native administrations. We have left the administration of justice as far as possible to native courts practising their own law. Ancient systems of taxation have continued. The administration of the Yoruba Provinces has subsequently been very largely modelled on the system in vogue in the north. We guide and direct government through the chiefs and their indigenous native organizations. Native treasuries receiving a proportion of all direct taxes have been the chief instruments. Hitherto the share has generally been 50 per cent., but next year it is proposed to increase this to an average of something like 70 per cent.

In south-eastern Nigeria, owing to the absence of organized chieftainships, owing to the more primitive social and political organization, and above all to the absence of direct taxation elsewhere than in the Cameroons Province, our rule has been more direct than indirect. Efforts have been made, however, to build up a system of native courts for dealing with the less important cases, both civil and criminal. These native court areas which we have established seem to provide the germ whose growth we are endeavouring to foster.

It is now proposed to extend direct taxation to the untaxed provinces and to build up native treasuries, under the combined guidance of leading headmen and our district officers, and with ultimate control by the latter.

The evolution from the isolated village community to the larger political group will necessarily vary in type and speed, but a beginning is just now being made. In northern and south-western Nigeria we are building on the foundation of native forms and traditions. In south-eastern Nigeria we have to create. We may expect steady but slow progress in our processes among the Sudanic peoples like the Ibos, but the proto-Bantus, especially in a Province like Ogoja, will probably present great difficulties. Their primitive ultra-democratic communism with little or no potential native leadership makes indirect rule extremely hard. They are of course much poorer in wealth and in productive capacity than the more varied society of Yorubaland and the Muhammadan north.

Among both the Yorubas and the Hausas a very rapid advance in the standard of living is taking place. The more enterprising individuals, whether cultivators, traders, or craftsmen, are getting rapidly wealthier. Among both the demand for education is proceeding apace. The Yorub is showing special adaptability as a mechanic, and he is now employed in his thousands as engine or motor drivers, fitters, carpenters, and the like.

The Yorubas already show a skill in such crafts far ahead of the Bantus of East Africa, who are presented with similar opportunities. On the whole the Yorubas, chiefs and people alike, show a more ready adaptability to modern progress than the more conservative Hausas. None the less some of the Northern Emirates—Katsina, for example—can be quoted as outstanding instances of the progress brought about by modern technical knowledge in agriculture and commerce. It would be difficult to find anywhere two more remarkable institutions than the Hausa survey school at Kano and the training college for Muhammadan school teachers at Katsina. The standard of quality set in both is far beyond anything I had any idea existed in native Africa, and is a good augury for the future.

Nigeria came under a single administration for the first time on 1 January 1914. The pace we are setting is a hot one. Some five weeks ago the Governor (Sir Graeme Thomson) informed his Legislative Council that he was proposing a continuous programme of new railway and motor road construction, amounting in the case of the former to 150 miles a year and in the latter 400 miles a year.

The impact of this development is likely to be far-reaching and will probably affect the different elements of society in Nigeria differently, and our task must necessarily be to prevent this development having too rapidly disruptive tendencies. We are pouring new wine into very old bottles, and it will be interesting to see how religious beliefs, social and political organizations that have obtained in Nigeria for centuries, will be modified under the stress of this impact.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: It would savour of something like impertinence for me to introduce to you a Minister of the Crown. From the Press, if from no other source, you have learned during these last two or three years of Mr. Ormsby-Gore's indefatigable journeying. I believe that he and his chief, the present Secretary of State for the Colonies, are the two most variously travelled members of the present administration; in fact, they are probably the most travelled members of any administration since Lord Curzon. There is no busier man in London or, indeed, in this country than Mr. Ormsby-Gore, and we are most grateful that he has consented to come and give us a general account of what he saw in the second of his two great colonial tours in Africa, that is, his tour in West Africa. As his time is more valuable than my own, I will not stand in his way but ask him at once to address you.

Mr. Ormsby-Gore then read the paper printed above, and a discussion followed.

The Hon. CHARLES RHYS, M.P.: I do not propose to keep you very long after the extremely interesting address that Mr. Ormsby-Gore has given, but may I very briefly elaborate one or two points? The address was entitled "Some Contrasts in Nigeria," and I think there may be few parts of the world where the contrast between European civilization and primitive peoples is more striking. I suppose that the city of Kano is one of the most astonishing places in the world. Mr. Ormsby-Gore mentioned that the walls of Kano are 13 miles round, and within those walls are not only the houses of the people but also a great deal of agricultural land. Before the British arrived in Northern Nigeria there was, naturally, a great deal of warfare, and it was extremely important that the people should safeguard their food supplies. For that reason they included within their fortifications the very necessary sinews of war. I believe Napoleon said that an army fights on its stomach. To stand on the top of a hill that is within the walls and to look out in the early morning, with the mists over the town, to listen to the sounds rising up from the native quarters, is one of the most extraordinary experiences I have ever had.

The Emir of Kano, and indeed all the Emirs of any importance, maintain considerable state still, and when we went to visit the Emir of Kano he sent a troop of his cavalry bodyguard to meet us at the gates, and we were taken through the streets of the town at full gallop, our motor car going as fast as the horses could gallop. They still have very proper respect for the white man, and the form of address not only to the white man but to any important native chieftain is that of "Lion," but should you be of greater importance you may be addressed as "Bull elephant."

There is, I suppose, in Kano something more like 'The Arabian Nights' and the city of Baghdad in the days of the Caliph than I imagine you could see in Baghdad to-day, for I am informed that the latter city is being spoiled from the picturesque point of view.

I suppose Ibadan is the most remarkable native city. It has a population of about a quarter of a million, and I believe it is the largest pure native city in the whole of Africa. Though I have touched on the picturesque side I do not think that such an audience as this should go away with the impression that our tour was nothing but a series of ceremonial visits and the taking of interesting photographs. There was the side of investigation of administration, of health, of education, and all the hundred and one services which we are running in that part of the world. Nigeria produces coal, mostly for internal consump-

tion at present, tin, cotton, palm oil, and ground-nuts. Palm oil is very largely used in tin-plate works in this country and for soap-boiling.

I would like to supplement the closing words of Mr. Ormsby-Gore's address. We are pouring new wine into old bottles, and the interesting thing is that it is nearly all the work of the present century. Therefore the present administrators are watching grow up the work of their own hands. They are not suffering the fate of so many administrators of the past who have not lived to see the full fruit of their efforts. We have, owing to our modern conditions of transport and our modern scientific knowledge, the rapid turning of a part of what I suppose could be truthfully called "the Dark Continent" into a country in which a European can walk from one end to the other carrying a walking-stick. It is not so many years since it was necessary to have armed expeditions to subdue tribes which had not been placed under our administration.

One of the things that struck me more than anything else is this: that because a man has a black skin he is not necessarily the same as another man who has a black skin. The people of Northern Nigeria are as different from the people of the south as, shall I say, the Scotsman from the Italian. The administrator will have to realize that he is dealing with different races, races which differ as much as the white races do. Therefore I think the colonial tours are of the greatest importance, not only to those who have the honour of sitting in the House of Commons, but to those who are members of the Colonial Office, because they will be there when, perhaps, our constituents may prove refractory! That tour gave an inside knowledge of part of our Empire which I fear is too little known.

The PRESIDENT: We have with us this evening Mr. Webster, who has had very long experience of Sokoto and, I believe, spent twenty-five years in Nigeria. Therefore perhaps he will find it difficult to tell you anything about the country.

Mr. F. G. WEBSTER: The President has said I shall probably find it difficult to tell you anything because I have been so long in the country and especially following on the able summary given by Mr. Ormsby-Gore, which he has been able to give you after spending six weeks in Nigeria as against my twenty-five years. Mr. Ormsby-Gore has spoken a great deal about the contrasts and the movement of the people. I am afraid we know very little about it, in spite of the efficient work of Mr. Meek, Mr. Talbot, and many others. He has mentioned the brass-work, especially that of Benin. We found the art of casting in brass still existing amongst the Lala tribe 40 miles north of Yola, though the people were so primitive that they went in a state of absolute nudity and lived in the most primitive way possible. Soon after we opened up the country in 1909 I went back there again and was presented with a little set of brass figures, beautifully cast and including a portrait of myself and my dog, faithful in the smallest details, even to the buckle on my belt and the crosswork on my topee. They apologized for giving me so few, stating that the supply of cartridge cases which the British had used had run out! Later on we found two very interesting figures, one representing a winged monkey and the other some curious monster with the legs and wings of a bird, apparently a pelican, and the body of a woman. How or from whence they got their art we have not the least idea.

It might interest you to know that in Sokoto there are still the remains of two stone citadels or fortresses. One was built by Kanta the revolutionary, who freed his people from the yoke of the Songhai Empire, of rough stone, more or less circular in shape and surrounded by a moat. The building

of Keawu in the Zamfara country, on the other hand, shows signs of considerable skill in masonry. The stones are roughly shaped and there is a wide road hewn in part through solid rock leading up to the chief gateway.

I gather I am expected to say something with regard to the Fulani. The ruling caste I do not think you can consider as being pure Fulani. Of the photographs shown us the man certainly was more Hausa than Fulani; the woman was nearer the Fulani type. The true Fulani is still nomadic. He lives for and by his cattle. They are almost his gods. Who or what the Fulani are, we do not know. The latest theory is that they were the remnants of the old Kushite invaders. They are a most interesting people, but I am afraid we know very little about them or what their language is. Some say the latter is the prototype of all the Hamitic languages. All we know definitely about them is that they were long resident between the Niger and the Senegal rivers, and eventually came down, abandoned in part their nomadic life, and took over the administration of the Hausa states to a large extent. On the other parts of the paper I do not feel qualified to say anything.

Mr. FRANCIS RODD: There is only one point on which I feel competent to speak. Mr. Ormsby-Gore mentioned the contrast between Southern and Northern Nigeria. I think he suggested, by implication, that the distinction was fairly modern on account of political difference in administration between the old colony and protectorate of the south and the area administered by the Niger Company. But I think there is perhaps another reason: the old Emirates of Northern Nigeria owe the civilization, which we found when we went there at the beginning of this century, to contact with the Mediterranean and not to contact with the sea-coast. There are many proofs of that; partly military, in that all the invasions of Northern Nigeria have taken place either from the north-west or from the north-east; a few, perhaps, from the north. I am not aware that any took place from the south. Secondly, trade was almost entirely between the Mediterranean and Northern Nigeria, and practically non-existent between Northern and Southern Nigeria until developed by Europeans. Consequently, you have the Emirates of Northern Nigeria facing north with their back, as it were, to a wall of almost impenetrable jungle through which they had no contact. Early explorers all came into Northern Nigeria from the north. It was only Clapperton's second expedition that led him up from the south through the bush. Therefore it is possible to suggest that the contrast is really of considerable antiquity, and that the making of railways and contact between the sea and the north are innovations which perhaps requires as careful watching as some of the other difficulties that Mr. Ormsby-Gore suggested, such as the contact of pagan and negro with rather more civilized law, and, as Mr. Webster will agree, the considerable differences of opinion which exists between the negroes of the south and the semi-negroid or semi-Semitic people of the north.

Sir HENRY GALWAY: I am afraid you will find me a little out of date. Mr. Webster spoke of going to Nigeria twenty-five years ago. Well, I left Nigeria twenty-five years ago, having spent twelve years there. I happen to have been about the third or fourth officer appointed by the late Lord Salisbury as Deputy-Commissioner to the Oil Rivers Protectorate, and the Benin country was my particular area. Mr. Ormsby-Gore spoke about Benin City, and I had the good fortune in 1892 to go up there on my own account. I went as a guest of the King. At that time there were not more than six or seven men living who had ever been there. The only hospitality I received when staying in the City (for five days) consisted of eggs sent me every morning

by the King, which were fit only for electioneering. I made a Treaty with the King; but no white man visited the City between my stay there and the punitive expedition of 1897, after the massacre of Mr. Phillips and his companions.

Mr. Ormsby-Gore said no horses lived there, Trypanosomiasis presumably keeping them out. I was twelve years in Nigeria and I never saw a tsetse-fly there! I had two ponies, which I kept in the Opobo district, and they lived for about three weeks. It was not the trypanosome or the tsetse fly that caused their deaths, but something in the vegetation which contaminated the water, and the ponies got paralysis of the loins. Curiously enough, about nine years afterwards I was Governor of Gambia, one of the tsetse-fly centres, so I speak of the fly with a certain amount of experience. There you have the tsetse-fly, the *Gambiense*, and in certain districts where the fly abounds, it is impossible to keep horses; but outside such areas you see groups of fifty or even one hundred men riding.

Southern Nigeria was called the Oil Rivers Protectorate in 1891 when Major Claude MacDonald was appointed Commissioner. None of us liked the name very much, and so the Foreign Office changed it to Niger Coast Protectorate, and that remained until 1898, when the Colonial Office took it over from the Foreign Office. Then we became Southern Nigeria, and eventually merged into Northern Nigeria. Southern Nigeria was the smaller, being about 64,000 square miles, whilst Northern Nigeria was about 300,000 square miles.

The Benin bronzes are very interesting to me because I happen to have a good number of them. I went up with the punitive expedition after the massacre in 1897, as Assistant Intelligence Officer to Admiral Harry Rawson. We took the City on 18 February 1897. We found bronzes there in enormous quantities and the most beautiful ivories also. Unfortunately, on the second day on which we were in the City, the whole of the King's portion was burnt down, through some careless person (carrier probably) having dropped a match, and tons of ivory were burnt to ash. We sent 300 bronze plaques to the British Museum, and they wrote a volume about those bronzes and ivories. Mr. Ormsby-Gore touched on the question of how the Bini learned the art, and said it went right back into the past. He is right. The British Museum authorities think that the art was probably taught the Bini by the Phœnicians, who were itinerant pedlars, as it were, and who travelled all over the world.

In 1898 I happened to administer the Government of Southern Nigeria for eleven months during the time that Sir Ralph Moor was home on leave. I went up to Benin City several times. I asked the King's brass-maker—the King was then a fugitive—if he would make me a bronze, and he said he could only copy. I gave him a bronze to copy, and he faithfully reproduced every detail; but the piece he produced looked like a Brummagem article. The Binis were also very clever in copying in the old days. I sent a pair of cannon to the Tower of London—Lord Dillon was curator at the time—and I told him I thought they were a pair of old Portuguese cannon. He said he was not surprised I should think they were a pair, but one was genuine, about the sixteenth century; the other a copy, which must have been made in Benin City.

It has been very interesting to hear Mr. Ormsby-Gore talk about a country one is very attached to. In the old days we only laid the foundation, and, as Mr. Ormsby-Gore said, it is the men of the present century who have the credit of having built up Nigeria as it is to-day. I can assure you the nine years we did in the last century involved pretty hard work, and we had no motor cars or railways! In fact, punitive expeditions were the order of the year—I think

every year we had one. It is good to think they are no longer required; but I suggest that some of the credit is due to those who laid the foundations and did the pioneering work. West Africa possesses an indefinable charm. Once you have tasted the fetish water, you have a longing to return there!

The PRESIDENT: I will ask Mr. Ormsby-Gore if he has anything more to say. I think the audience would be interested if for two or three minutes he would show us on the map some of the practical results of his expedition, particularly where the new roads and railways are to go.

The Rt. Hon. W. G. A. ORMSBY-GORE: I must first reply to the remark of Sir Henry Galway in connection with tsetse-fly. I was bitten by a tsetse-fly and killed it on my hand within 3 miles of Benin City. There are a great many varieties. I cannot vouch for the following story, though I was told it in Nigeria. When the Northern Provinces headquarters were at Lokoja some one made a polo ground and had a certain number of ponies there. Everything went well until they came to the conclusion that the polo ground wanted rolling. They got two of the Benin cattle brought up the Niger on a steamer. The cattle rolled the ground beautifully and lived for many years, but every pony was dead within three weeks. Some of these cattle have been tested, and their blood was found to contain trypanosomes. As a matter of fact, I have seen dogs in East Africa go in the loins like the ponies Sir Henry Galway mentioned from trypanosomiasis. Probably one of the most important campaigns of the Colonial Office, from Gambia to Zululand, is the campaign against tsetse. In the past there have been frequent failures to diagnose disease of both man and animals as trypanosomiasis. My point is that the infection of the tsetse and other flies with different forms of trypanosomiasis seems to have been spreading in comparatively recent times.

As to railways, the railway actually in course of construction is in the direction of Sokoto. It has been surveyed, and material ordered, to a place called Gusau. In the Governor's speech to this Legislative Council five weeks ago he foreshadowed that they will not stop at Gusau, but take the railway forward so as to tap a place called Kara-na-Moda and on to the place in which I first met Mr. Webster, namely, Talata Mafra, on the Sokoto road, which may there tap that Zamfara valley containing the stone remains which Mr. Webster referred to.

Then they are going ahead with carrying on the main line from Lagos to Kano to Hadeija, about 80 miles north-east of Kano, and that will bring the area down the Hadeija river more within economic radius of the railway system.

Then there are two railways in the south in the Governor's sanctioned programme; a railway in the cocoa-growing area between Ife and Benin in the Province of Ondo, and the railway that is to be built either from Aba or from Port Harcourt to Owerri or Onitsha. Such a branch would eventually link up with the Niger. We can only do about 150 miles of railway a year on account of labour, permanent staff, and the rest. Other projects you will see in the report that I published, including a railway from Oturkpo to endeavour to open up the Munshi country.

The great market for ground-nuts is Kano. I have heard of ground-nuts grown in the Munshi district being carried, long before the Eastern Railway was thought of, by caravan all the way up to Kano for sale there, and then being brought down by railway again for shipment. Apart from that, the agricultural research officers at Ibadan have now practically isolated a very much improved type of native cotton that will grow in the area south of the Benue

and the Niger. The American types of cotton are grown in the north, in the area of which Zaria is the centre. American cotton has been tried in districts where native cottons have been grown for centuries in the south, but it is not successful there, as the local conditions and pests are harmful to it. The Agricultural Department have now obtained, by seed selection and by breeding, an improved local native variety that will grow in the south, superior to the existing native cottons and to most of the American varieties. It is known as "improved Ishan."

The other eventual railway which, when all those branches which are immediately paying and economic propositions have been worked out, is that from Lafia towards Lake Chad. That is a big proposition involving about 500 miles, and such a railway will cost a great deal, but it is the only thing that will eventually tap the million people who live in the Chad area, and will develop all the country between the Bauchi plateau and the Benue. There are in the eastern area signs of mineral deposits. Bornu is good cattle country, and if the railway gets there it will be one of the most go-ahead and productive parts of Nigeria.

The PRESIDENT: Mr. Ormsby-Gore has once more shown that same remarkable power of taking a wide sweep over country which he showed—not to this audience, unfortunately—in speaking to various assemblies about East Africa. If we have made a joke about his having been in the country only six weeks and therefore being able to give a general account of it, while Mr. Webster, having been there twenty-five years, is unable to do so, we know in all seriousness that Mr. Ormsby-Gore's success is due to his confining himself to general features which are assured and ascertained; whereas Mr. Webster, in the course of twenty-five years, has gone beyond these into matters of detail about which he and, I think, also Mr. Francis Rodd have showed quite clearly we have not yet full knowledge—details in particular which concern the semi-archæological, semi-ethnological question about the origin of the Nigerian peoples. All I can say is that I have got a general impression that not the Arab people but the Arab influence has penetrated a very long way indeed into that Nigerian country. I ask how the name Yoruba, which is well known on the other side of Arabia, has come down there. Other names too, like Ibadan, have a curiously Arab sound. The Arab was apt to be on the top of streams composed of a great number of other people who were not Arabs; and all kinds of languages have come down in the wake of the Arab and under his leadership. Mr. Ormsby-Gore has cleverly and wisely chosen a scheme of contrasts in order to show us what is ascertained by the best authorities and what is the accepted gospel now in His Majesty's Government about this great and important dependency. He has done that as, I believe, no one else could have done it for you to-night, and I hope you will express your gratitude.

NEW ROUTES ON RUWENZORI

Captain G. N. Humphreys

Read at the Meeting of the Society, 21 February 1927. Map follows p. 604.

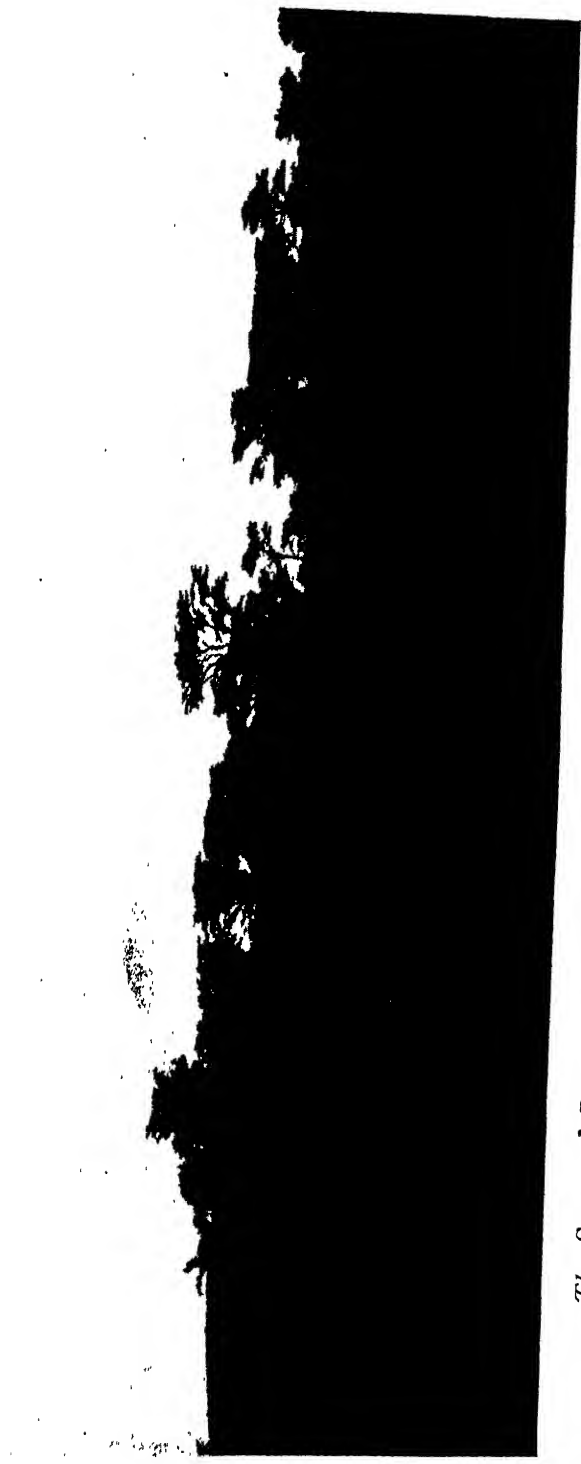
IT is remarkable that for more than twenty years explorers were operating in the neighbourhood of the Ruwenzori range without discovering the snows. It is perhaps more remarkable that they attached

Mt. Baker

Portal Peaks

Mt. Speke

Mt. Gessi



The Snows of Ruwenzori from Hima, about twenty miles east by south from Mount Baker
Phot. Dr. D. Garnett



Phot. A. G. Elli

Edward Peak, Mount Baker (right), and twin peaks of Mount Stanley in distance

so little importance to the accounts of natives of mountains whose summits were lost in the clouds, or were shining white, or were covered with salt. When in 1888 Stanley had his attention drawn to a mountain the summits of which were visible and, according to the native, covered with salt, he even then at first thought he was looking at a remarkable cloud formation, and the full extent of his discovery only slowly dawned on him.

It was not until 1900 that the snows were reached for the first time by Moore. Between that date and that of the expedition of the Duke of the Abruzzi were many expeditions of which the most important was the British Museum Expedition of 1906, members of which made the first ascents in the range, climbing two peaks which were afterwards named Wollaston and Moore Peaks. In 1906 the Duke of the Abruzzi, with perfect equipment, Alpine guides and porters, and good fortune in weather—he had ten fine days in a month and a half—carried out an entirely successful piece of exploration: climbing the highest peaks and bringing back material for a map showing the position and extent of the six snow mountains of the range with their peaks and glaciers.

During the next twenty years no fresh ground was broken in the range, and no peak re-climbed. Last year, however, two small expeditions were able to add slightly to the knowledge of the range. The first expedition was undertaken jointly by Mr. D. Stedman Davies, of the Uganda Civil Service, Mr. E. H. Armitage, and the writer; it started at the end of January and returned—nine days overdue—on March 9. Preparations included the collection at Fort Portal of seventy outfits of sweaters, vests, shorts, and blankets for porters, with fifty extra blankets and fifteen sets of boots and stockings. Food for the Europeans was ready packed in light loads, about 45 lbs., and loads of millet flour had been collected at Ibanda.

The porters collected at Fort Portal were replaced at Ibanda by Bakonjo porters, as these men were accustomed to the valleys of the range, where they hunt hyrax. Early in the morning after the arrival of the expedition at Ibanda a party of natives was sent off with grass knives to cut a way through the vegetation on the lower slopes, in advance of the main party, which started the same afternoon. The first night was spent at Mihunga, which had been the headquarters of the British Museum Expedition and is the last inhabited spot on the way to the snow-peaks. The next day the expedition passed through some of the typical zones of vegetation which begin and end so abruptly.

In the first zone after Mihunga a podocarpus tree was conspicuous, and there were many brilliant flowers, including a pale mauve climbing solanum, a begonia, and a purple terrestrial orchid. Next was a zone of bracken which had a curiously English effect. This gave way to a zone of mixed vegetation, and from that the expedition passed suddenly into the bamboo zone, which would have been impenetrable but for the path which had been cut through it. The stems of the bamboo were

NEW ROUTES ON RUWENZORI

it 30 feet high and about 5 inches in diameter and of a beautiful green colour. A greenish light filtered through the foliage, and the ground was covered with maidenhair ferns and a balsam with a large pink flower, and here and there were tall arums with the spathe red cream and pale green. That night, still in the bamboo zone, Nyinabitaba was reached. This is the first of the rock shelters which are so typical of the range. The name means "Mother of Tobacco," and was given by the native hyrax-hunters because of the use made of the shelter as a store during their hunting trips.

The next day the Mobuku, the Mikasabira, and Bujuku rivers were crossed and the most beautiful and interesting floral zone reached. Here were species of ranunculus like the English spearworts, a cardamine like lady's-smock, a viola like the dog violet, bog-orchises, docks, nettles, a rubus with fruit bigger than the loganberry and flowers as large as a red rose, and two species of tree hypericum, one with yellow flowers and the other with large flowers of a flaming orange.

The intention had been to reach the rock-shelter Nyamuleju that night, but on reaching the shelter Kanyasabo the porters refused to go further, saying that Nyamuleju was "bad," and that every one died there. The next day's journey was mostly along the Bujuku river through swamp, which consisted of tussocks of rush about 3 feet high, and between them mud covered with moss. One could jump from tussock to tussock and eventually land thigh-deep in the mud, or one could plod steadily calf-deep through the mud. The porters sat on the tussocks and dropped their loads in the mire.

That evening the shelter Kigo was reached. The porters had been out of hand and causing trouble by throwing down their loads and threatening to desert; and matters now came to a head by their refusing to continue the journey unless they were supplied with outfits. It was contrary to custom to provide more than blankets for porters going to the glaciers and back, and only sufficient outfits had been brought for such porters as were to remain with the Europeans at the camp which was intended to establish in the neighbourhood of Stuhlmann Pass. The cause of the trouble was partly that most recent expeditions had been only to the glacier and back, whereas this expedition was known to be planned for a longer stay in the mountains, and partly that an expedition a short time before had encountered a snow-storm while crossing the Scott-Elliot Pass and four porters had died of exposure. Eventually it was decided to divide the porters into "blanket men" and "outfit men"; the former were to carry provisions between Nyinabitaba and Kigo, and the latter were to go on with the Europeans and to fetch stores from Kigo to the advanced camp when necessary.

The next day Bujuku shelter and lake were reached. This was the last shelter known to the porters and normally used by hunters. While this camp was being established a reconnaissance was made up to

Stuhlmann Pass in order to find a suitable site for an advanced camp. Just south of the pass at the foot of Mount Speke, a shelter was found which had been used by natives, as was shown by the presence of two unbroken cooking-pots. The porters did not know of this shelter, and were puzzled by the presence of the cooking-pots. Just beyond the pass, on the same side of the valley, another shelter was discovered. This showed no signs of human habitation, but had been in long and recent occupation by leopards. The next day camp was moved from Bujuku shelter to Leopards'-lair. Owing to the mutinous state of the porters this took most of the morning. In the afternoon a reconnaissance was made up Mount Stanley, but heavy rain and thick mist prevented useful exploration. Until that evening, owing to continual mist and frequent rain, the snows had not been visible, but at about 7 o'clock, when it was nearly dark, the sky cleared and the snows of Stanley plateau were seen.

The vegetation of this, the highest, floral zone of the range is characterized by the omukoni tree, a species of senecio, herbaceous lobelias about 15 feet high, shrubby everlastings, a galium like the English cleavers but with purple berries, a sweet-scented arabis, an herbaceous senecio, like ragwort, and a true umbellifer. The most useful plant is the omukoni tree, which provides abundant fuel, though the wood burns with little flame and much smoke. The large leaves on fading fold back against the stem and the dead leaves are kept dry by the dying. These dead leaves are valuable for starting fires and for bedding. There was not enough space under the rock-shelters to pitch a tent, and elsewhere all level ground is swamp. Full advantage was taken of the dry omukoni leaves, but it was only a matter of time before the weight of one's body brought water to the surface.

The natives mostly did not wear the clothes issued to them, but made them up into neat parcels to sell on their return. Such natives as wore the clothes invariably took them off at night, because crouching over the fires of omukoni wood they felt the heat better on their naked bodies.

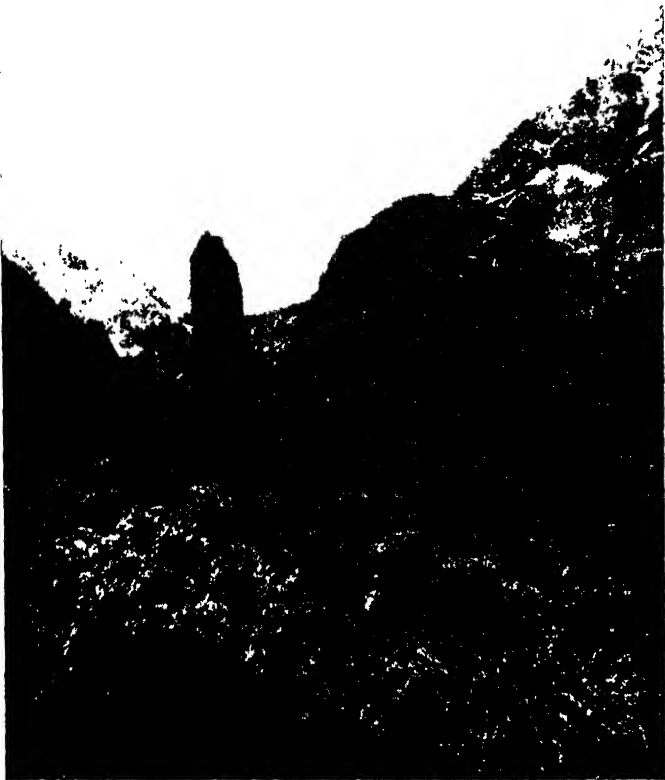
The first attempts were made to climb Mount Stanley by either the north-north-east or north-north-west ridges, both of which led to the precipitous northern face of the mountain. The obvious line of approach was from the south, but as the northern ridges were unexplored they offered more interest. Later both ridges were crossed and the glacier reached which flows north-west from the col between the two highest peaks. This glacier offered a route to the summit, but it would have been necessary to establish a high camp or transfer the main camp to west of Mount Stanley, and, with the porters prepared to desert at any moment, this project had to be abandoned. All these climbs on Mount Stanley had been in thick mist and frequent rain, and it is possible that with clear weather a way up one of the northern slopes could have been found.

The next attempt was on Mount Speke. During the attempts on Mount Stanley camp had been moved to "Mid-valley" rock-shelter, which had been discovered in the middle of the upper part of the valley running north from Stuhlmann Pass, and this camp was equally convenient for the attempts on Mount Speke. Occasional glimpses of this mountain showed three main peaks. Of these the centre peak had been climbed by the Italian expedition and named Vittorio Emanuele. The north peak, unnamed, had not been climbed, nor had the southern peak, which the Duke had named Johnston Peak. The attempts were made by the north-west ridge. It was necessary to cut steps up the slope, and on two days the expedition was driven back by snow-storms which obliterated the steps which had been cut, so that they had to be recut on the morrow. The third attempt, on February 16, was successful; the northern peak was climbed and the high ridge traversed to Vittorio Emanuele Peak, which was also climbed. From the summit of each of these peaks and from the ridge between them it appeared that the peak to the north was slightly the higher, but at neither peak was the other visible long enough to enable observations to be taken. During this day little snow fell, and at times the mist was thin enough to enable the position of the sun to be made out and its warmth felt. This was the only occasion during either expedition when, while on the snows, the warmth of the sun could be felt.

The expedition now moved camp to "Cooking-pot" rock-shelter. It was not possible to leave this to the porters, and a day was lost, which loss was especially unfortunate as it was the only completely fine day during the expedition. From this camp attempts were made to reach Margherita Peak by the south-eastern ridge, which leads directly to the summit. These attempts were made in continuous mist and frequent rain or snow, and they failed, though in fine weather it is likely that a way could be found up this ridge, which offers the most direct route to the highest peak.

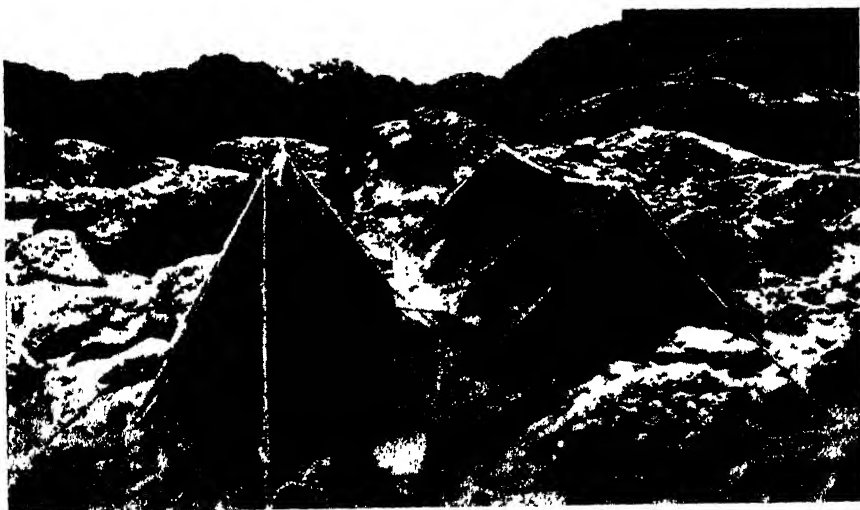
Only five days were now available for climbing. The easiest route to the Stanley plateau is the south-eastern ridge, which was ascended without difficulty on each of these days and each day spent wandering about the snowfield in dense mist. Not the slightest glimpse of the Twin Peaks was gained until the last day, when in the late afternoon the expedition was on its way back.

The main divide of the range runs through each of the six snow mountains, Gessi, Emin, Speke, Stanley, Baker, and Luigi di Savoia. The passes between the mountains were named by the Duke of Abruzzi: Roccati, Cavalli, Stuhlmann, Scott-Elliot, and Freshfield. Of these two—Roccati and Cavalli—had not been crossed. To the north of Roccati Pass lay the largest unexplored area in the range. The highest part of the range had not yet been crossed; expeditions to the snows from the east had returned to the east, and those from the west to the



Phot. E. H. Armitage

S.E. spur of Mount Stanley (right), and Mount Baker (left) from Stuhlmann Pass



Phot. G. Oliver

High Camp on Mount Stanley



Phot. G. N. Humphreys

Second lake in valley west of Scott-Elliott Pass



Phot. G. N. Humphreys

Johnston and "Trident" peaks, Mount Speke

west. The objective of the expedition was now to travel over Cavalli and Roccati Passes and to complete the crossing of the range through the unknown area. Word was sent back to Kigo and Nyinabitaba for the men to break up camps and return to Ibanda. More detailed plans depended on the natural difficulties encountered and on how soon the porters deserted.

The first day we struck camp at Leopard's-lair, recrossed Stuhlmann Pass and the north-western ridge of Mount Speke, and reached Cavalli Pass. This is the ridge joining Mounts Emin and Speke. As day drew on and no rock-shelter was discovered it was considered advisable to descend to the nearest valley, which lay to the north-west. The way to the valley was in most places precipitous, and it took four hours to get the party down the cliffs. It was now nearly dark, and as no rock-shelter could be discovered we had to camp in the open. Snow fell at intervals during the night, but luckily there had been time to collect fuel, and fires were kept burning. Next morning the ridge was reclinbed and a difficult descent was made into the valley running south from Roccati Pass. Proceeding up the valley a small lake was discovered. There were three wild duck on the lake, the first so far seen. Near the lake was a rock-shelter, and a camp was made here rather than risk another night in the open.

Next morning, just as the expedition was ready to start the men refused to go on. Some stood in groups shouting, others ran away and hid. The three headmen were loyal but without influence over the men. When the Europeans announced that they were going on alone some of the men volunteered to go with them, but when a start was called they changed their minds. Eventually tent, bivouac, rifles, blankets, spare food and clothes, etc., were left in the rock-shelter, and the Europeans started off, each with only a waterproof cape and a ruck-sack containing food and photographic material. The three headmen and three porters followed, carrying only their own food and blankets.

The valley north of the lake was choked with enormous boulders which had fallen from the cliffs above, some quite recently, for the leaves of the omukoni trees broken by the falling rocks were scarcely faded. At the head of the valley the expedition reached a sharp ridge overlooking the lake which had been seen by the Italian Expedition from Böttego Peak, Mount Gessi. This lake was in a small self-contained basin, surrounded by precipitous or overhanging cliffs. The rest of this day was spent in finding a way round this lake, it being necessary to climb up to the snows of Mount Gessi before this could be done. Rain fell steadily throughout the day. By dusk the northern rim of the basin was reached, and here a large rock-shelter was discovered, the largest and driest yet found in the range. It was too late to cut wood, but fortunately some dead omukoni trees were found which had fallen inwards under the rock-shelter. Nothing had been seen of the six natives

since soon after the start, but after dark they arrived at the shelter, having followed our tracks. One had fallen and lost his load, which had dropped into the lake. As soon as the fuel was burnt up it became very cold, as the shelter was only just below the snow-line.

Next morning the expedition completed the crossing of the Roccati Pass and climbed down a steep slope into a valley running first north and then north-north-east. Following a stream round a spur of Mount Gessi, a lake about a mile long was discovered, larger than any lakes previously found in the range. Following the shore of the lake, and the left bank of the stream issuing from it, another and rather larger lake came into view. After passing this lake the expedition left the valley and moved north-west across a treeless plateau carpeted only by two species of *alchemilla* growing about 3 feet high. Here we saw one of the Ruwenzori red duikers, a race of duiker which is peculiar to the range, and of which a specimen has never been shot, although they have often been trapped by natives. The porters were now expecting to find tracks of native hyrax-hunters from the Congo side of the range, and they frequently left the Europeans to follow supposed tracks. Across the plateau a valley and rock-shelter were found, and here a camp was made. The next day we followed a valley, reached the bamboo zone, and made a camp in the open. The natives had not been seen during the day, as they had been following possible tracks which had however faded out, but they reappeared after dark.

Next day we reached the zone of mixed vegetation immediately below the bamboo zone, and progress here was slow. For some hours we had to pass through a belt of nettles 5 feet high, which stung painfully even through thick clothes. The valley had now narrowed down to little more than the river-bed, and night was spent camped beside the stream.

The next day the sides of the valley became so steep that it was necessary to wade down the river-bed. In the water a dead duiker was found, so far decomposed that flesh remained only on one leg, which was brought along by the porters for food. The walls of the gully were in most places vertical, but where tributary streams flowed into the river the cliffs could have been scaled, and that native hunters sometimes visited the valley was presently clear. In crossing a piece of level ground beside the river a giant forest hog was found with its foot caught in a noose. The animal was immediately killed by the natives with heavy stones and grass knives and large portions of its flesh brought along. It was not possible to find the track by which the native hunters had reached the valley, and the expedition continued to wade down the river-bed. Shortly afterwards a dead and much-swollen rat was found in the stream, and added to the supplies.

That night was spent on a piece of marshy ground beside the stream, and it rained at intervals throughout. The next day also was spent wading down the river. Cascades became more frequent, and it was

often necessary to climb along the face of the cliff to avoid these waterfalls. The valley was strewn with tree-trunks which had fallen from above, and on one occasion a trunk wedged across the stream made a convenient bridge across a cascade. Towards evening the cliffs on either side were less high, and it was clear that the foothills were near. At one point, climbing up the side of the cliff to find a way past a cascade, a distant view was obtained of the sunlit plains of the Congo. Later on, to avoid a cascade which could not be passed, it was necessary to return upstream until a way could be found up the cliffs.

By the time the ridge was reached it was dark, and the night was spent at a spot where the slope was so steep that we had to be anchored against trees to prevent sliding downhill. The next morning, warm and dry for the first time for over a month, but suffering from thirst, as no water had been found since leaving the stream, the expedition pushed its way downhill through elephant grass out on to the native track which skirts the foothills. This track was followed northwards, the Bwamba Pass over the northern foothills crossed, and Fort Portal reached in two days.

The second expedition was undertaken in July of the same year by Mr. E. H. Armitage, who was on the first, Messrs. R. T. Wickham and N. F. S. Andrews, of the Uganda Civil Service, and the writer. At the last moment the expedition was fortunate in obtaining the services of Mr. G. Oliver, who came in charge of the porters.

At Ibanda the porters who had deserted us before were most anxious to rejoin. The six men who had kept with us had been well paid, and our success in crossing the range had entirely restored their confidence. This time the men gave no trouble. The same route was followed, a base camp established at Cooking-pot rock-shelter, and a high camp at about 15,000 feet at a spot on the south-eastern ridge of Mount Stanley, which had been selected during the previous expedition. The porters slept at the base camp, but brought up fuel and food each day to the high camp. Below, on the Congo side of the ridge, the site of the high camp of the Italian expedition could be made out. Each day the expedition ascended the south-eastern ridge and reached the Stanley plateau. During each day there was almost continuous mist and frequent falls of snow. Occasionally glimpses could be had of the Twin Peaks, and each day some progress was made in their direction; but most of each day was spent waiting on the plateau in dense mist for some clearing which might allow progress. Luckily no snow fell heavy enough to obliterate the tracks of the day before, and each morning after the first it was possible to go straight to the limit of the previous day's journey and there to await a thinning of the mist which would allow further progress.

On the eighth day the Twin Peaks were reached, just twenty years

and a day after their previous ascent by the Duke. The route followed was first a descent to the Margherita Glacier, then an ascent of the south-eastern ridge of Margherita. Just below this ridge was a cornice which presented some difficulty. The ridge was then followed without difficulty until just below and to the north of the summit, where progress was checked by a more formidable cornice, up which however a way was found. From the summit of Margherita a descent was made to the col between the Twin Peaks, and from the col the steep slope was climbed to the summit of Alexandra Peak. The actual summit of this peak was found to be on a cornice overhanging the entrance to a large rock and ice cave.

Immediately after the ascent of the Twin Peaks the high camp was struck and another high camp formed just below the snow-line on Johnston Peak, Mount Speke. On the way to this camp we climbed a jagged rocky peak at the extreme south of Mount Speke, known to us as "Trident Peak" from the shape of its summit. The next day Johnston Peak was climbed without difficulty. On the way up the Bujuku valley, on arrival at Kigo rock-shelter, a small snow-covered peak had been seen which appeared to be just behind the hills immediately north of the shelter. In attempts to locate this peak Mount Johnston was reclimbed twice in the next three days, but mist prevented any view in its direction.

Camp was now struck and the whole expedition crossed Scott-Elliot Pass *via* the site of the high camp on Mount Stanley. This required a higher climb than the usual crossing of the pass, but the way was easier for the porters. A camp was formed at a rock-shelter beside the lower of the two lakes on the Congo side of the pass, and that evening for half an hour before sunset the sun was seen for the only time during this expedition. The next day we crossed Freshfield Pass and made a high camp just below the snow-line of Mount Baker, the natives camping at a rock-shelter lower down. The next day, in the usual mist and with occasional falls of snow, we ascended Edward and Semper Peaks. On the former peak was a card of the Duke of the Abruzzi, where it had remained untouched for twenty years, and on the latter was a note written by one of the Duke's party. The next day, from the same camp, we climbed Stairs and Sella Peaks of Mount Luigi di Savoia. The expedition then returned by the Mobuku valley, visiting Moore Glacier on the way.

Both expeditions had experienced the bad weather which had hampered all earlier visits to the range. In February and March we had one quite and one nearly fine day in about a month and a half. Only one day had been quite free from rain or snow. During the expedition of July it rained or snowed every day, and the sun was only seen for half an hour on one occasion. On neither was it possible to take observations from the summit of any peak. While we were away fine weather was



Phot. E. H. Armitage
Mount Emin from Cavalli Pass



Phot. G. N. Humphreys
Looking from Rocati Pass across end of first lake
north of the pass



experienced in Fort Portal, where there are definite wet and dry seasons. From the total experience of all expeditions to the range it would appear that although spells of clear weather may occur in any month there is no time of the year when they should be expected.

Glacial action is traceable in the valleys many miles below the present level of snow, and the diminution of the glaciers would appear still to persist. Cairns built by the Italian expedition are covered with lichen of growth subsequent to their erection, but at a much lower level rocks *in situ* just below the glaciers are entirely devoid of vegetation. Many of the lakes would appear to be receding. The omukoni tree will grow in swamp but not in standing water, however shallow. Large areas in the valleys are dotted with omukoni trees all young, while at a slightly higher level the trees are of all ages.

With the development of Toro and increased transport facilities expeditions to the range are likely to be more frequent, and observations on climatic changes should prove of great interest.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: This Society has often heard about Ruwenzori. The close connection of Mr. Douglas Freshfield, Mr. Mumm, and Dr. Wollaston with this Society has secured that. It has also heard an account of the explorations of the Duke of the Abruzzi. But it has not heard anything, I think, for about twenty years, and therefore special interest attaches to the fact that we are going to have to-night an account from, I think, the only traveller who has ascended all the peaks, more or less—I am not sure whether I am correct in saying that he has ascended them all. We may regard to-night as the crown and summit of a long series of explorations of those misty Mountains of the Moon, the mere existence of which was for so long doubted. Captain Humphreys, who is about to address you, is an adventurous person, who flew before the War, flew in the War, was then penned in a German prison for something like four years, and then, when the War was over, took up survey work in Uganda. It was while he was engaged in this survey work that he made the very thorough exploration of the Ruwenzori range, which he is about to describe to you. He has, I believe, left the Uganda service, but not without having added a very distinct contribution to our previous knowledge of Central Africa. I will now ask him to address you.

Captain Humphreys then read the paper printed above, and a discussion followed.

Mr. DOUGLAS FRESHFIELD: The region we have heard of to-night, one of the most remote on the world's surface, the inmost heart of Africa, is from many points of view of extraordinary interest to other than mountain explorers. Our attention was first called to its scenery by Sir Harry Johnston, who, unfortunately, is not well enough to be here to-night. His beautiful book certainly was the one that first drew me to think of going to Ruwenzori. The region has a political importance, since it lies on the frontier of Uganda and the Congo State. In 1894 the statesmen of the two countries confessed their lack of knowledge of the local topography of this part of Africa by taking the 30th meridian east of Greenwich as the boundary between the two States. Later on they found that the 30th meridian was wrongly placed on the maps they used; that it lay considerably further east. The result was to give the

whole of Ruwenzori and the Edward Lake to the Belgians, which had not been at all their intention. So a compromise was made by which the crest of the mountains was recognized as the boundary. This arrangement has not been without its inconvenience. It has had an unfortunate effect, particularly to explorers of Ruwenzori. I do not know how things may be now. I am told that the population has been shifting backwards and forwards, the natives alternately trying British and Belgian control, and coming on the whole to the conclusion that they prefer British. Twenty years ago the tribes on the west flank of the range did not receive strangers gladly, as Dr. Stuhlman and Mr. Wollaston both found out. Consequently, there still remains a field for detailed exploration on the western flank of the range; the valleys that slope towards the Semliki river.

As to the higher region, the Duke of the Abruzzi's wonderful expedition has narrowed the unknown, though he did not altogether cover the field, as you have learned from the very interesting lecture we have had to-night. The Duke explored the eastern glens, and climbed, one after the other, the snowy summits. I am afraid I can add very little to what you have heard to-night from Captain Humphreys, or what some of you heard twenty years ago at the memorable meeting in the Queen's Hall at which the Duke read his paper and King Edward himself took the chair—the only time, I believe, when our Sovereign has taken the chair at a Geographical Society's meeting.

My own visit to Ruwenzori with Mr. Mumm and a Zermatt guide was in the year before the Duke's: that is to say, in 1905. In choosing the time of year I acted on the advice of the friend whom I had every reason to believe would know best—Sir Harry Johnston. Unluckily, he did not realize that the climates of Entebbe and Ruwenzori are distinct. It was not until after our arrival at Fort Portal that we learned from the missionaries and the native headmen there that in Toro mid-winter and midsummer are the best seasons for the mountains. I advised the Duke to this effect, and he took my advice; and I think on the whole the result proved that it was not bad advice. I have been at the pains to analyze his Table of Ascents. Ruwenzori is, of course, always a desperately bad place for weather, but between June 19 and 28 nine days out of eleven were fine enough for snow climbs. In the first eleven days of July the Duke's party climbed on seven! That surely is not a bad record for Ruwenzori. If you want further proof that the time of year was fairly favourable, you can see it in the wonderful series of photographic panoramas and views taken by my friend Vittorio Sella, the prince of mountain photographers, some of which you have been shown to-night. Yet I can honestly say I do not regret our own bad luck, for had we succeeded the Italians would never have started for the Equator, and we should not have had Sella's photographs.

Of the picturesque features of Ruwenzori it would be easy to talk for the rest of the evening, but I shall confine myself to a very few sentences. Let us begin at the top—the region above the snow-level, above 15,000 feet. The summits, despite their nearly 17,000 feet, do not vie as a rule in boldness of form with those of the Alps or the Caucasus. They are moderate and for the most part dome-shaped protuberances crowned by glaciers which are in the nature of ice-caps rather than ice-streams; what in the Alps are called "Secondary Glaciers." But the snow region of Ruwenzori has one singular feature, of which you have seen a beautiful specimen—those fairy-like grottoes, with their pendant icicles and crystal columns which support broad cornices projecting like eaves from the ridges of the loftiest peaks of Mount Stanley.

It is of the middle region of the mountains between 8000 and 15,000 feet that I should like, if I had the power, to give you some of my impressions. They are amongst the most vivid of a lifetime of travel. That enchanted forest has a weird and grotesque effect that is all its own. In the mists and gloom of the frequent rainstorms it may suggest a nightmare caused by studying the illustrations of Palæolithic vegetation in some text-book. In the rare sunshine one may fancy oneself enveloped in the scenery of a Russian pantomime. The open glades bristle with the upright stalks of lobelias, green obelisks 12 feet high, like tombstones in a Turkish cemetery. They are mixed with senecios, writhing stems, crowned by mops of spiky leaves, fit for a witch's broom. High up a white everlasting *Helichrysum* covers acres with a sheet of its silver or golden blossoms. On the precipitous slopes and ledges tree heaths drip with the perpetual moisture. Gaunt and grey, draped in preposterous masses of moss and lichen, they look like the vegetable ghosts of a departed world.

You may be familiar with the Alps and the Caucasus, the Himalaya, and the Rockies, but if you have not explored Ruwenzori you have still something wonderful to see and do. Our last view of the range was the strangest of all. It was from its foot, at sunrise. Our porters called us out of our tents by their shouts to witness the wonderful spectacle. The whole range, not only the snows, but also the dark Portal peaks and the wooded heights, was immersed in a deep blood-red glow. Tennyson's line, "God made Himself an awful rose of dawn," seems best to express the strange vision.

Mr. E. H. ARMITAGE: I have very little excuse to be here, because I am no biologist, or zoologist, or anything like that. But your Secretary said I must stand up and let myself be seen. There will be some who envy me for having been in the Ruwenzori Range, and there will be others who will say, "Well, poor fool!" Anyhow, both sorts may like to look at me. Still, there are one or two things that I should like to say, though there is very little that I can add to Captain Humphreys' most excellent paper, if I might say so, describing our journeys. One thing that stands out vividly in my memory is one day when we were on the Stanley plateau at the foot of Alexandra Peak. There was just a clear moment between the drift of the mist, and we saw down into the Belgian Congo. I suppose it must have been 12,000 or 13,000 feet below, and we could almost pick out where the vegetation changed—where there was forest and where there was grass; and we could see the remarkable Semliki winding below. That does stand out most in my mind: standing at the top and just thinking of the people below in the sun—very hot, very uncomfortable, I expect, and we were standing out, very cold and also rather uncomfortable. There are definite periods, of course, down below of dry and wet weather, but whether that has anything to do with the climate at the foot of the snow is very hard to say. The rivers flow down into the Semliki on the western side and down into Lake George on the eastern; surely, you may say, you will be able to tell from the spate there whether it is wet or dry up above. But I do not think that is true, because we noticed on a very wet day the rivers were swollen in the evening from the rain, one presumes, and on a very fine day they were also swollen from the melting of the snow in the sun. So, to my mind, the storms up above have very little to do with the storms below, and at any time of the year up above is as good as any other time. But, on the other hand, getting up there you do meet rivers swollen by water which has been collected on the lower foothills.

Colonel E. M. JACK: Some years ago Captain Humphreys and I occupied

adjoining stools in the Geographical Section of the War Office. He was occupied in making air maps, and I was occupied in making maps of another description. It is a great pleasure to meet him again to-night and to hear his account of a phase in the new life which he has been following since that time. It is, almost to a day, twenty years since I reached the neighbourhood of the country Captain Humphreys has been describing to you to-night. I went out as a member of the Boundary Commission, in command of Colonel Bright, which was sent to map the country along the 30th meridian, as Mr. Freshfield told you, with the object of settling the question of how geography lay in that part. On that Commission and in the year that followed, when I took a share in carrying out the geodetic survey of the 30th meridian arc, I travelled up and down the eastern side of Ruwenzori a good many times, and made a circuit of the mountain and ascended to several points on it. We had no time on that expedition to do any mountaineering; our job was simply to map the country. I have not, therefore, the intimate knowledge of the higher peaks that Captain Humphreys has; I can speak only from the surveyor's point of view. My business, as the officer in charge of triangulation, was to fix the positions and heights of as many features of geographical interest as I could, and I was naturally very anxious to fix the peaks of Ruwenzori. I was very favourably situated for that purpose, occupying high ground all round the mountain. And yet I found it a most extraordinarily difficult task. The difficulties were twofold. First of all, in the dry season, the fog in that country is so thick that you do not see the mountain at all. We found that in the height of the fog which covered the country in the dry season we could not see beacons which were 4 or 5 miles away; they were quite invisible. The whole mountain at that period is entirely invisible, and we know the classic example of that is the fact that Stanley in 1874 was near the mountain for a long time and did not even know of its existence, and it was not till fourteen years later, in 1888, that he first saw it. I took every opportunity I could of observing the peaks, and I do not think I missed any opportunities. I developed the art of tumbling out of bed and getting my theodolite up and adjusting it to a really high degree of perfection; and, in spite of that, I only got seven observations to the summit, seven independent observations from four stations: so that shows that it is rather a difficult object to see. In the dry weather the fog is the difficulty; and in the wet weather, when the air is ordinarily clear, the summit is usually hidden by clouds. The only time I found you could see the summit was just before sunrise. As soon as the sun warms the air the clouds rise and hide the peaks altogether. I only saw the mountain clear once. That was on our homeward journey, when we were a long way off, and by that time all the instruments had been packed and sent away.

Captain Humphreys spoke about his being the first party that had crossed the range. I do not know exactly what the technical meaning of crossing a range is, and I feel I have to be rather careful with members of the Alpine Club sitting just in front of me. But I should like to mention the fact that Corporal Thomas on our expedition crossed the mountain from west to east, reaching a height just under the snow-line of about 14,000 feet, carrying out his mapping the whole way. That may not be technically crossing the mountain, because of course he did not cross the summit, but I think it is worth mentioning.

Just one other point. I think, Sir, it is an honourable tradition amongst those who speak after these lectures to disagree with something the lecturer has said, and I propose to honour that tradition. Captain Humphreys has

constantly used the expression "Ruwenzori Range." Now years ago, when we had just come back from that country, and we were often talking about Ruwenzori and that very remarkable series of volcanoes away to the south, I commented on the curious perversity, as I think it, with which people would describe Ruwenzori as a "range," while they talked of the volcanoes, which consist of some eight entirely separate and distinct peaks, as "Mount Mfumbiro." Ruwenzori appeared to me to be a mountain pure and simple. It is one long ridge about 70 miles in length, and rising to one culminating group of summits, and I cannot understand why people call it a range; it seems to me to be essentially a single mountain. That may not appear to be a very important point, but as a Fellow of the Royal Geographical Society, I am a stickler for accurate geographical description. With that exception, I would like to congratulate the lecturer very much indeed on his paper, which I found extraordinarily interesting. He did not dwell on his difficulties very much, but he must have had very great discomforts and difficulties, which required a large amount of courage and determination to overcome.

The PRESIDENT: Would Mr. Mumm care to say anything? He was one of the earlier climbers who saw Ruwenzori.

Mr. A. L. MUMM: I am very glad to have this opportunity of congratulating the reader of the paper on his most interesting discourse and his equally interesting slides, which carried me back to what was my first experience of travel off the beaten track. I have only very few remarks to make, and the first one is this: He began his paper at Fort Portal; any account of our expedition would have had a chapter, as the Duke of Abruzzi's expedition had a chapter, on the journey from Kampala to Fort Portal. Captain Humphreys probably accomplished that journey in two days in a car. I believe you can do it, if you make a long day of it, in one. It shows how things change in twenty years. It took us a fortnight, and during twelve of those days I do not think we had a single decent drink of water. That impressed itself on me very much. It was my first experience, as I say, of rough travel.

Going to Ruwenzori itself, the other thing that struck me was that I did not gather from the narrative at what moment in their progress the party got from the Mobuku Valley into the Bujuku Valley, though the latter was found by the Duke of Abruzzi to be the key to the exploration of the range. By the way, I think "the Ruwenzori range" is undoubtedly the proper geographical description. We walked past the junction of the two valleys without being aware that there was any Bujuku Valley or Bujuku River at all; and I think I am right in saying that it was the Duke of Abruzzi's expedition which discovered it for the first time. The consequence of that was that we arrived at the head of the Mobuku Valley amongst some minor peaks, and that of all the mountains we have been introduced to this evening we never saw one, except once or twice at great distances when we were not on the Ruwenzori Range at all. I think that is rather an interesting illustration of the gradual way that geographical knowledge grows. We walked past the mouth of the Bujuku Valley, just in the same sort of way that people until a very few years ago, on Victoria Nyanza, went past the mouth of the Kavirondo gulf without knowing it was there; or, to come to a more modern instance, just as the first Mount Everest Expedition went by the mouth of the East Rongbuk Glacier Valley without knowing it was there.

The PRESIDENT: Is Canon Fisher here? I think he has lived round about Ruwenzori a long time, engaged in missionary work.

The Rev. Canon A. B. FISHER: It is nearly thirty-four years since I first

saw Ruwenzori. I have followed with intense interest the different expeditions to that mountain, and I think we have been listening this evening to a most modest account of one of the greatest achievements in the exploration of Ruwenzori. It was about 6 March 1893 that I got my first view of the great mountain. I remember a Uganda chief, as he pointed in its direction with a wave of his hand, saying "Gamalaga gafumba biri," which in our language meant, "The great leaf in which the clouds are boiled." I found amongst the Bakonjo, as well as the Baamba, who live along the slopes, that this was a name for the mountain very well known to them; and, after a residence of more than nine years in that district, I can quite understand how that proverb came into use. It is most fascinating to live there for any length of time, all the year round, and to see the atmospheric changes and the behaviour of that tropical mountain. Sometimes you see incessant electric currents passing into the top of it. Again, you see all the clouds in the rainy season for 100 miles round or more literally being dragged down, coming at different paces, and when they get to the centre of the mountain they steady, and then in half an hour or more there are astounding thunder concussions, and the rain falls all over the country with tremendous force. Or, on the other hand, different clouds may be thrown down from the top of the mountain, and steady themselves sometimes, and form out along the slopes; and then, when the sun comes out brilliantly after a storm, you see the ridges of the great mountain illuminated behind four or five different-coloured clouds. While acting as chaplain to Bishop Tucker, the great apostle to the Baganda—who was, by the way, an artist and a member of an artist family, and had his pictures hung in the Academy before he became a clergyman or a bishop—I can remember how fascinated he was with the aerial effects and atmospheric conditions upon the mountain.

I ascended, in 1903, with my wife—who is, I think, the only lady who has got up to the glaciers. I was the leader of the expedition; the other member was the present Bishop of the Upper Nile, Bishop Kitching. I am not at all surprised that Captain Humphreys found it difficult to get the natives to go on from different altitudes; my surprise is that he got them to go at all, because of their desperate superstition. They are animists of the most primitive type, and all these great forces in Nature are worshipped by them or propitiated in the most gruesome manner. Thunder and lightning, the rocks and the trees, the torrential rains, the force of the rivers, and everything like that, are awe-inspiring to every single member of the Bakonjo tribe.

When I wrote home soon after our expedition to Ruwenzori and told my friends that I had seen the stuff they feed their canaries on growing from 25 to 30 feet high, blackberries as big as my fist, and heather from 25 to 30 feet high, they of course said, "Oh, well, he has written from the centre of Africa, and he is an Irishman!"

I can understand a remark made here this evening by, I think, our veteran explorer, whom I remember very well coming to Toro soon after I had left—Mr. Freshfield. He said, "You may have seen a European glacier, but an African glacier is a very different thing indeed." It is indeed. You look at a great glacier and ice-fields shining in the tropical sun. It stands out like a magnificent silver shield, and seems to glint and throw out colours with an iridescence indescribable. The difficulty of climbing these peaks has been put in altogether too modest a way to-night. I have never listened to a more modest lecturer in my life.

The PRESIDENT: Previous speakers have said most that I wished to say.

I was as impressed as they have been by the extraordinary amount which Captain Humphreys left out ; that is to say, all the struggle and the toil which brought him to the points from which his photographs were taken. I felt that there was a very long story of endurance and very grim determination behind the taking of a great many of those views. I ask you, with the utmost confidence, to give him your thanks. I have a good long experience of public meetings, and I know perfectly well that you have been interested. I will ask you to express in the heartiest possible way your thanks to Captain Humphreys for a very remarkable lecture and a series of very remarkable pictures, and for an altogether exceptional self-effacement.

Note on the Nomenclature of Ruwenzori, by the Editor, G. F.

The nomenclature of the Ruwenzori Group is the last conspicuous example of the practice which was once commended, but is now happily avoided, of affixing European names to geographical features in Asia and Africa. It is of course true that one can rarely obtain genuine native names for peaks and glaciers of a mountain group even if there is a name for the whole massif. It is equally true that for description one must have names for individual features, and the difficulty is to give names to such features which shall have at any rate the appearance of belonging to the region. Sir Halford Mackinder when he climbed Mount Kenya had the happy idea of giving to the two peaks the names of legendary Masai chiefs and heroes. The Mount Everest Expedition when they were on the ground adopted English descriptive names which were after translated into Tibetan, and those appeared upon the maps.

The present nomenclature of Ruwenzori is due to the Duke of the Abruzzi, who after his successful exploration of the range consulted Doctor Stuhlmann, Sir Harry Johnston, and others, and with careful consideration gave the names of the famous early explorers of Africa to the groups, and to the peaks the names of Members of the Royal Houses of Italy and Great Britain, the names of previous explorers of the range, and of members of his own expedition. We have therefore on the map a mixture of several categories of European names for the peaks and glaciers, and native names for the rivers. With all respect to the rights of the illustrious traveller whose expedition made so complete a conquest of the peaks and study of the range, we feel that it would be a great advantage if after the most friendly discussion it were possible to agree upon euphonious names of native appearance for the peaks and glaciers, before the present exotic names have become irreplaceably established. With the intention therefore of leaving this possibility open we have on the accompanying map retained the six names of the six snow-clad groups, including of course the eminent name which the then President of this Society very naturally, after the Duke's paper, insisted should appear conspicuously upon the map ; but the names of the individual peaks are given in a list and identified by their spot heights. This may be held to have the double advantage that the topography of the range is not obscured by a large number of names, and the possibility of reconsidering those names is tentatively suggested.

THE TWO OLDEST MAPS OF CHINA EXTANT

The Reverend W. E. Soothill, Professor of Chinese in the University of Oxford

Read at the Afternoon Meeting of the Society, 14 March 1927.

IT is in tribute to the memory of two friends, both great authorities on the geography of China, as well as in the interest of the subject itself, that I have undertaken to deliver this lecture. Sir Alexander Hosie, in years gone by so esteemed a contributor to the work of this Society, had happily completed his admirable Map of China, showing the commercial products of the country, of which a copy is in the collection of the Society. No sooner had he completed this very complicated and valuable work than he yielded to the persuasions of Col. Dudley Mills to study the two maps which are the subject of this paper, and before his death he had written a part of this lecture. The second great authority is M. Edouard Chavannes, whom I had the pleasure of entertaining in T'ai-yuan-fu, when he was on his archæological exploration. His lamented death deprived the world of an exact and brilliant Sinologist. He had already published an exhaustive article on the two maps in the *Bulletin de l'École Française de l'Extrême Orient* (Avril-Juin 1903). I have myself carefully studied that article and compared it with rubbings I obtained through the kindness of the Rev. J. Watson of Hsi-an-fu, Shensi, before the late prolonged siege of that city. I have also compared it with treatises in Chinese and with Playfair's 'Cities and Towns of China,' and should like to add my tribute of high regard for M. Chavannes' usual carefulness and thoroughness. If I differ from him in certain particulars it will be with head still bowed in respect. As his article was published nearly a quarter of a century ago, and is now hardly available, even to a French reader, it seems advisable that the two maps should be discussed in English.

The following is Sir Alexander Hosie's introduction to the subject, written in August 1924 :

The Chinese have for many centuries made maps of their own country. It would seem as though cartography were an instinct implanted in every nation with any claim to civilization. At the very time that the Romans were engaged on making maps of the whole of their Known World, Chinese were, in all probability, occupied with the same task—a task which, considering the area of China and her boundaries and the number of cities involved, was no mean one, as I myself, who have been recently engaged on the same duty, can amply testify. In a review of my map, I was interested to read this comment: "China takes great credit to herself for her age-long 'civilization,' her ancient learning, and the scholastic attainments of her literati, but with it all such a mundane necessity as cartography appears to have been entirely overlooked." As a matter of actual fact, China has, in the course of the centuries, been entirely and completely mapped in detail by the Chinese,

although of course not scientifically, since they were unaware that the Earth was round. Indeed, in the archives of every city in China there are carefully preserved maps for the use of the magistrate of the administrative area concerned. These are often beautifully executed, astonishingly accurate, although perhaps containing a wealth of detail that appears to us irrelevant. Nor do these maps remain unused, as I discovered in a discussion on the matter with the magistrate of Tsangwu on the West River, the district city within the administrative area of which lies the city and open port of Wuchow. In fact, he kindly presented me with a printed copy of the history of the place, illustrated with maps. Chinese officials were frequently moved about from one city to another, and doubtless found these maps of great benefit in their work.

The two most ancient maps of China known to exist were discovered in the Forest of Tablets at Hsianfu, the capital of Shensi province, in the far interior, their existence being made known to the Western world by Monsieur Edouard Chavannes, formerly Professor of Chinese at the Collège de France. They are graven on stone slabs set up in this "forest," which is a collection of most valuable and ancient monuments gathered together in that city. These slabs, with innumerable other stone tablets on which are cut, amongst other works, the Thirteen Classics or Canonical Works, including the Nine Classics of the T'ang Dynasty (618-907), with similar records of antiquity, specimens of calligraphy and portraiture, are stored in a series of low buildings known as the Pei Lin, or Forest of Stone Tablets. The Pei Lin is now, as I saw when in Hsianfu, the home of the famous Nestorian Tablet. This, after being buried for many centuries, was erected about a mile outside the west gate of Hsianfu; and from this spot was removed again when an enterprising foreigner roused suspicion in the Chinese mind by causing a replica of it to be made, which was intended for America, but is now deposited in Rome. The Chinese feared the original was to be removed, and the replica substituted; for the tablet, like the others in the Pei Lin, looks as fresh to-day as if it had just been cut, and it would be hard to distinguish between them.

Through the offices of a French father, M. Chavannes was able to secure rubbings of the treasures of the Pei Lin, and, amongst others, of two stone-engraved maps. M. Chavannes, the most distinguished Sinologue of modern times, whose industry, acumen, and scientific zeal were beyond admiration, published a most informative and instructive exposition on the main features of these two maps. As, however, Chavannes, to the great regret of all who knew his work, has died, and his brochure can be obtained only from Hanoi in Tonquin, I may perhaps be pardoned if, together with my own observations, I recapitulate some of Chavannes' findings.

These two maps, the most ancient in existence in China, as far as is known, have the year of their engraving cut on the stone, the year called Fou Ch'ang, which M. Chavannes reckons as 1137. But the first reference to a map of China made in Chinese records is found in the work of the great Chinese historian, Ssü Ma Ch'ien—partly translated by Chavannes—who relates that, in 227 B.C., the Prince of the state of Yen, fearing the territorial ambitions of Prince Cheng, of the state of Ch'in, later known as Shih Huang Ti, or "First Emperor," sent his heir presumptive to the court of the latter with the avowed object of presenting a Map of the District of Tu Kang, which was to be handed to Prince Cheng. The real object, however, was the assassination of the Prince; for the map, which was carved on wood, was packed in a box, and when Prince Cheng drew it out, a poisoned dagger lay behind, which the

emissary essayed to use. The plot failed, however, and the would-be assassin was arrested.

During the civil war which followed soon after the death in 210 of the "First Emperor," his capital at Hsien-yang, in Shensi, was sacked by the Prince of Han, and maps were discovered there.

There is ample evidence in the histories of the two Han dynasties, the Former Han and Later Han, to show that, in addition to wood, silk was used for writing and for map-making. During the Later Han paper was invented in A.D. 105 by a chamberlain of the Emperor Ho Ti, named Ts'ai Lun, an invention which proved an excellent substitute for cumbersome wood and expensive silk. But there can be no doubt that all these maps were rude drawings intended for military, administrative, or engineering purposes, and, to judge from later maps, had no pretence to scientific accuracy.

Passing over the epoch of the Three Kingdoms, we come to the Western Chin or Tsin Dynasty (A.D. 265-317). Its first emperor, Wu Ti (A.D. 265-290), appointed a very remarkable man, P'ei Hsiu (224-271), Minister of Works in 267. P'ei Hsiu may be justly entitled the Father of Chinese Cartography. He studied all existing topographical matter and maps, and constructed a new map in eighteen sheets, which the Emperor deposited amongst his secret archives. To this map, which was on the scale of 500 *li* to 1 inch, P'ei Hsiu added a Preface in which he laid down his valuable Six Principles of Cartography. (They are given later.) His six principles were undoubtedly a very great contribution to cartography.

Notwithstanding the invention of paper, map-carving in wood was not extinct; for, in the Annals of the Liu-Sung Dynasty (420-473), it is related that one Hsieh Chuang (421-466) carved a map in wood, 10 feet square, showing mountains, rivers, and the general configuration of the country. This map consisted of detachable pieces which could be removed and put together again.

The T'ang Dynasty (618-907), one of the most renowned in Chinese history, pursued a policy of conquest in the west and south, and in its annals frequent mention is made of Treatises on Geography with maps of conquered western territories. Such maps were made by Hsu Ching Tsung in 658 and Wang Ming Yüan in 661, while in the reign of Hsüan Tsung (742-756) Wang Chang Ssu, in obedience to the emperor's commands, constructed a map showing the frontiers of the foreign countries bordering on China.

In 785 Chia Tan, a famous cartographer of the T'ang Dynasty and a worthy successor to P'ei Hsiu, received the imperial commands to construct and present a map of the whole of China. Ill health prevented him from carrying out these commands until 801; but in the meantime he was able to prepare a map of the country, including Kansu and part of Szechwan, which had been occupied for some years by Tibetans, and from which they had lately been dislodged by Chinese armies. In 801, however, at last his masterpiece was produced. It was entitled "Map of China and Foreign Countries Within the Seas." The Chinese character which I have translated "foreign" is literally "barbarian," and was officially applied to Europeans along with other non-Chinese nations when they first came into contact with China. This map, which was on the scale of 100 *li* to the inch, measured 33 by 30 feet, and must have covered a much greater area than what is known to us as China of to-day. No doubt it included the bordering countries which paid China tribute.

Li Chi Fu (758-814) was another celebrated cartographer of the T'ang

Dynasty. He constructed a map for the Emperor Hsien Tsung (806-821) showing the strategic points north of the Yangtse, and he was the author of a work entitled 'Map of the Regions and Kingdoms during the reign of Yuan Ho.' This work was divided into fifty-four books, in which were described the important towns in the Empire, mountains, rivers, and the general lie of the country; and the description of each district was prefaced by a map.

When the Emperor Hsien Tsung, in 821, gave his daughter in marriage to the Chief of the Ouigars, one Yüan Chen, in order to console the mind of his sovereign with regard to the long journey which the Princess had to undertake, prepared what was evidently a route map from the then capital Ch'angan, now Hsianfu, in Shensi, to the Ouigars' encampment in the north. He marked the various stages where the Princess would eat and sleep and the general configuration of the country.

Following the T'ang came the Five Dynasties, which lasted for only fifty-four years, when they gave place to the Sung (960-1126) and the Southern Sung (1127-1278). In the histories of these two latter dynasties frequent reference is made to maps by such cartographers as Sheng Tu, who presented the Emperor Chen Tsung (998-1022) with maps which he made of the regions to the west of the present province of Kansu; and Shen Kuo (1030-1093), who was the first to produce a Relief Map, namely of the frontier districts which he visited. This map had a wooden foundation on which mountains, rivers, and roads were shown by a paste of flour and sawdust. These substances, however, did not withstand frost and crumbled away in winter, necessitating the substitution of wax, which was lighter and more portable. Shen Kuo himself describes the construction of this relief map, and tells the following story about map-making. When a Korean embassy was bringing the customary tribute to the Chinese Emperor Chen Tsung (1068-1078), the members of the embassy requested and obtained from the authorities *en route* maps of the country through which they were passing. The Prefect of Yang, who thought this very suspicious, under pretence of complying with their request, asked them instead to allow him the use of theirs that he might take copies. When he once had them in his hands, however, he burnt the whole collection and reported his action to the Emperor! The dread of map-making is not yet dead in China. In 1910, when I was inspecting the cultivation of opium in the northern provinces, one of the first questions put by the Viceroy at Lanchow in Kansu to the Chinese deputy who accompanied me, and whom he received privately, was, so the deputy told me afterwards, whether I was making maps of the country.

The fact that the Korean mission was collecting maps of the country shows that map-making, which had hitherto been confined almost entirely to production for Imperial use and that mainly for purposes of warfare, was becoming more common under the Sung Dynasty. Previous to this, maps made for the emperors were stored in their palaces, and as these were sacked during wars and rebellions, there is little wonder that no trace of their existence remains to-day. For of all the above-mentioned maps, not one is known to be in existence at the present time. The two earliest existing ones are those described by Chavannes and graven on stones, now in the Forest of Tablets in Hsianfu, in the twelfth century, although it is evident that both these maps must contain much material handed down from older specimens.

The first thing that must strike the most casual observer is the general truthfulness of these two maps. When one considers the size of the country, which is almost as large as Europe, and its miserable means of transport,

one stands amazed at the accuracy of those cartographers of the twelfth century. The characters also, which are wonderfully clear, bear no trace of archaism. The Tribute of Yü, Map B, in addition to the advantages of its squares, is more trustworthy with regard to the sea-coast, and its presentation of the Shantung promontory is notably more accurate than in Map A; but Map A is possibly its superior in dealing with the waterways and river systems, and shows mountain ranges, besides including the Great Wall. The lines in Map B are not, of course, for latitude or longitude, but for distance, each square representing 100 square *li*.

Now these engraved maps being evidently copies of older specimens, the question arises: What were the dates of the originals from which they were copied? Chavannes, by dint of sifting internal evidence, came to the conclusion very convincingly that the original of Map A, the map without the squares, was drawn somewhere between 1043 and 1048, *i.e.* towards the middle of the eleventh century. The fact that there is another stone tablet at Chinkiang, brought to his attention by M. P. Pelliot, on which is engraved the selfsame map, but at a little later date than the one in the Forest of Tablets, seems to confirm his conclusion. Chavannes even says that the map was originally drawn by a geographer who was a subject of the Liao throne during the eleventh century A.D. He could find no internal evidence in Map B, however, which gave him a clue to the date of the original from which it was drawn, and it is, therefore, with Map B that I shall deal in the main.

It has been the custom in China on the fall of a dynasty to change or modify many of the place-names, and even to change not a few during the course of a dynasty. For example, when the present Republic succeeded the Manchu dynasty, scores of place-names were either completely changed or so modified as to necessitate the compilation of a new map to bring the geography of China up to date. It is, moreover, extraordinary to find how soon the new names entirely oust the old in many cases. In 1919, only eight years after the establishment of the Republic, I had occasion to visit a place called Lai yüan Hsien, on the borders of Chihli and Shansi. Though this is a Hsien city, the residence of a stipendiary magistrate, I could find no trace of it on any map, until I was informed by a Chinese gentleman that its name till 1912 had, under the Manchus, been Kwang chang Hsien, and as such it was easily found on the maps. When I reached the city neighbourhood, I found the new name in common use and the old one practically forgotten. In the same way, foreigners in China knew very well the name of Honanfu, a city in Honan province. This was changed in 1912 to its old name of Loyang, a city now famous as the seat of Marshal Wu Pei Fu, and the name Honanfu, except to foreigners, is obsolete.

When, therefore, one examines an old map of China, the place-names thereon should indicate the dynasty in which it was compiled, while if the date when the map was engraved is also given, as in both these cases, there should be clear evidence that the names were antecedent to that date. This may seem a truism; but one can never jump to conclusions in things Chinese, for it often happens, as it has happened in a number of instances in the present republican nomenclature, for example, Loyang itself, that the old names are revived after many centuries.

Map B, as engraved on its stone, measures 31 inches from north to south, and 30 inches from east to west, and the two maps are much the same size. It is divided into squares bounded by seventy perpendicular, and seventy-three horizontal, lines. At the top it is entitled in bold characters:

MAP OF THE FOOTSTEPS OF YÜ ; 100 li to the Square.

Names of the Mountains and Rivers in the Tribute of Yü.

Past and Present Names of Provinces and Departments ;

Past and Present Names of Mountains, Rivers and Lands.

Cut in stone in the fourth moon of the seventh year of

Fou Ch'ang (*i.e.* A.D. 1137).

The title of this map requires explanation. In the year B.C. 2297, during the reign of Yao, the Kingdom of China, which then consisted of parts of the modern provinces of Shensi, Shansi, Honan, and Shantung, and with its capital at Yanghsia in Honan, was visited by a great flood caused by the overflow of the Yellow River, so well and deservedly known as China's Sorrow. This particular flood, so it is said, was almost on a level with the tops of the mountains, and the greatest difficulty was experienced in draining off its waters. Emperor Yao, on the advice of Shun, who later became his associate in the government and still later his successor, called in a young man named Yü, who, after eight or nine years of unremitting toil, succeeded in regulating the rivers and digging canals, and thus clearing the country of water. The story runs that so earnestly did he wrestle with the waters that, though he frequently passed the door of his home on his work and could hear his young son cry, he never saw him till his duty was accomplished. As a reward Yü was granted a small state in Honan called Hsia, and Shun designated him as his successor to the throne. On the death of Shun, Yü established the first Chinese dynasty and named it the Hsia in B.C. 2205, and is himself known in Chinese history as Ta Yü, or the Great Yü. The Yü Kung, generally translated the Tribute of Yü, which forms part of the Chinese classic, the Shu King, describes the work of Yü in draining the flood, the wide territory through which he passed, and the tribute each region had to offer. Our map is therefore styled "The Footsteps of Yü."

On examination, this Map B, which is so far as at present known the earliest extant map of China, having been engraven some six months before Map A, shows that the information contained in it is not confined to that given in the classic work, "The Tribute of Yü." Compared with present-day maps of China its general configuration of the coast-line, the courses of the rivers and their tributaries, and the positions of the cities or districts are remarkably approximate. On occasion the author of either this or the original, has been misled by the maps from which he copied. Thus, the Yellow River, which is accurate enough at its two bends, is made to enter the Gulf of Chihli at about where Tientsin stands now, the copyist's eye having evidently been caught by the trend of the Tientsin River. In the same way, there is confusion of the lakes and waterways towards the mouth of the Yangtze.

The names in both the original maps are, of course, cut in Chinese characters. I have been at some pains to transliterate these into our Western script in order to make the maps intelligible to those unacquainted with Chinese, and in order also to render it easier to compare them with our own European maps, which in spite of inaccuracies, must be, owing to our more scientific methods, our criterion for the geography of China. But once again, pitfalls may entrap the unwary. I am not at all sure, for instance, that the makers of either map have meant to indicate the exact location of any city or town. The city of Chungking (Yü on maps A and B) is itself on the very bank of the Yangtze, and the city of Canton (Kuang) lies spread over its river's banks. In both the maps these "cities" are given a little inland: so that it would seem as if possibly the cartographers were occupying themselves rather with administra-

tive areas than the exact location of walled cities, a supposition which is borne out by the fact that maps were peculiarly for administrative and military use. Moreover, when examining the history of these city names, as given by Playfair in his 'Cities and Towns of China,' and comparing them with these on our maps, it is often exceedingly difficult to disentangle adjacent administrative areas.

Map B has none of the notes around its borders found on Map A. These notes refer to the "foreign countries" included under the heading of the latter map, and these are not included under the heading of "The Tribute of Yü." None of the outside countries actually figures on Map A, except a portion of Korea, and many of the notes are historical as well as geographical. Some are merely concerned with the names of warring and troublesome tribes to the north of the Great Wall, but others refer to the great journeys undertaken by Chinese generals and embassies in the past, to conquests made *en route* and tribute gathered—journeys as far as the Persian Gulf and the Oxus. One note speaks of the country of the Brahmins, "which covers an area of thirty thousand *li* and possesses cities by hundreds." Such notes give us some idea of what was the Known World of the Chinese at that date, besides quickening our admiration for the intrepidity of those early travellers. Modern Chinese maps, in the same way, often have on their borders names of countries and peoples who once, possibly centuries ago, paid tribute to China. It is reported that the Chinese map of China hanging to-day in the Peking office of General Feng Yu Hsiang, the "Christian general," still contains Burma as part of China. And it must not be forgotten that Burma paid tribute to China for some years even after our occupation. One note refers to the Great Yü. It says: "When Yü separated the nine provinces, at the east he gradually arrived at the sea; to the west he reached the moving sands"—a striking phrase very descriptive of the condition of things in Central Asia.

It would be beyond the bounds of an article in this *Journal* to take each of the places on the maps and compare its name and position with those on a modern map. This is a task which may interest some future geographer of China. My intention is . . .

Thus ends Sir Alexander Hosie's article, and what his "intention" was we need not discuss, for intentions do not always tally with conclusions. I purpose instead to refer again very briefly to the history of Chinese cartography without, I hope, undue repetition of what he has written, and then to consider more in detail both of the maps, especially with regard to their origin and period.

The history of cartography in China is made the more difficult because the character 圖, *t'u*, connotes a good deal more than a "map." To-day it means "a plan" and "to plan," a drawing, diagram, map. Whether originally it meant anything of the kind it is impossible to say. As an official record it may perhaps have meant merely a table, or schedule. The *Chou Li* tells us that a Chief Controller (*Ta ssü t'ü*) had in his charge the *t'u* of the empire's territory, from which there was knowledge of all the lands of the nine divisions with their extent, east and west, north and south; the mountains, forests, rivers, and so on were differentiated, as also the States, political divisions, and individual estates. But it is doubtful if the *Chou Li*, as we have it, existed before

the first century of our era, and, apart from the unreliability of this record, its description does not help us to prove that the various *t'u* over which this official and his clerks had charge were maps and plans in our sense of these terms.

The *Shan-hai-ching*, or Classic of the Mountains and Seas, is spoken of by one Chinese writer as a kind of map. It is really a book of marvels attributed to the Chou period, B.C. 1122-255, but, as it stands, is of comparative late date. The book, *inter alia*, speaks of the variety of tribute depicted on the nine metal tripods of the Emperor Yü, B.C. 2205. Because of this statement and of the extraordinary animals mentioned in the book, this writer would have us believe that it is the source and origin of European cartography, for as our early maps are ornamented with strange animals, the idea must have been transmitted to the West by the Arabs; ergo, Western cartography arose from so fanciful a book as the *Shan-hai-ching*.

The first mention of a *t'u* which may perhaps be called a map, or diagram, is that which was presented by Ching K'o in B.C. 227 to the Prince of Ts'in when he availed himself of his gift to attempt the murder of the prince. That prince, the self-styled "First Emperor," after crushing his rivals and unifying the State, collected all the *t'u* of the various States in his capital. Twenty years later, B.C. 207, when his successor was overthrown, the Han Minister Hsiao Ho, while all the attacking generals ran off to pillage, himself sought the inner precincts of the palace and collected the ordinances and regulations, the *t'u* and the records, all of which were the keys of government. From these *t'u* the new ruler of the Han dynasty, B.C. 206-A.D. 221, learned the passes, the census by hearths (or families) and by individuals, the strategic places and the localities where the people were in difficulties. These *t'u*, engraved on wood, existed till the end of the first century A.D. Chavannes thinks they described only a limited territory, and that they were of the nature of topographical plans, or panoramic views. He does not consider that we have any evidence of the existence at that time of any map of the whole empire. This is a view in which I am inclined to concur, notwithstanding that the empire then was a comparatively small affair.

Returning to B.C. 128, we find that after the return to China of Chang Ch'ien, China's first historic traveller or explorer to the Oxus, the then Han emperor, generally known as Wu Ti, for the first time fixed the name of that famous range of mountains, north-west of the empire, known since his day as the K'un-lun. He gave it the name of K'un-lun, because ancient records had said that the River, *i.e.* the Yellow River, took its rise in marvellous mountains of that name, and Chang Ch'ien described its source as being there in Yarkand and Khotan. It was in 117 B.C., under the same Emperor Wu, that a *yü-shih*, a censor, or high officer, offered him a *Yü Ti T'u*, a term which will challenge criticism if I translate it by "Map of the Vehicle-land." Here we have the first reference

to this term *Yü Ti T'u*, and *Yü Ti* has become the general name for Geography. Now *Yü* means "the body of a cart," and by metonymy "a cart," or "vehicle," and one is led to raise the question: Was this earliest known *Yü Ti T'u* a route map, or a journal of the routes or roadways which vehicles could travel? I can give no definite answer to this question, but it is reasonable to assume that some, if not all, ancient Chinese maps were route maps, and that the Chinese term I am discussing may be indicative of this meaning.

In B.C. 99 the *t'u* sent by General Li Ling to his emperor showed the line of his long march against the Hsiung-nu or Huns, from Lake Sogok in Mongolia to the mountain 浹稽, Chün-chi (or Hsün-chi). He indicated the mountains, watercourses, and configuration of the places passed. In A.D. 26 we read of the Emperor Kuang Wu making use of a *t'u*. As to a *Yü Kung T'u*, a title similar to that of our map B, the first mention of such a map was in A.D. 69, when Ming Ti, the then ruler, commissioned Wang Ching to repair a breach in the Yellow River, China's perpetual sorrow. He gave him, among other things, a "Map of the Tribute of Yü," the famous reducer of China's historic Flood. This is the first mention we have of a map of all China, and it could only represent a part of the present-day area. A modern Chinese writer assumes from this reference that his country then without doubt possessed complete maps of China and the surrounding States, and he deplors the fact that no description whatever of them or of their character remains. Chavannes also considers that these first-century *t'u* were veritable maps, certain of them representing the whole empire, but he adds that there is no proof they were constructed according to a rigorous method. I see no reason to doubt that they were maps, whose simplicity and crudeness are later attested by P'ei Hsiu of the third century A.D.

There seems to me, therefore, little doubt that charts, or route maps, were in existence some time before our era, for nothing is more natural, even among people who are ignorant of maps, than the indication by stones or twigs of relative distance and of the curves and angles of the road. Among the Chinese, a people with a system of writing at that time still nearer the pictorial stage than now, it would be the most natural thing to indicate routes, including mountains and rivers and even boundaries, in chart fashion. But this is only the embryonic stage of cartography. The real advance begins when configuration, orientation, and distances are described with initial accuracy. While I see no reason to doubt that the *Yü Kung T'u* of A.D. 69 was a genuine map, however crude, of all the then known China, yet it seems clear that the stage when configuration, orientation, and distances were shown was only reached in the third century A.D.

Then arose P'ei Hsiu, the father of cartography in China. Born in A.D. 224, serving under two dynasties, dying at forty-eight years of age, he produced a map in eighteen sections, which was received by the

emperor and placed in the secret archives of the palace. Of this map no known trace remains. It may be taken for granted that he built upon the foundation of progressive predecessors, of whom, beyond those already named, we have no mention. But P'ei Hsiu made the first known scientific contribution to cartography in China. His map in eighteen sections is known as "The Map of the Territory of the Tribute of Yü." In his preface he says: "Cartography (literally, drawing and writing) has come down to us from the past. From of old men have set up pictographs and transmitted models and have relied on their utility. The three dynasties (Hsia, Shêng, and Chou, *i.e.* down to B.C. 255) appointed for them officers, imperial writers (or historians) holding these appointments. When the slaughter by the Han troops took place in Hsien-yang the chief minister, Hsiao Ho, obtained possession of all the maps and records of (the overthrown dynasty of) Ts'in. But now there are no longer any ancient geographical maps, and none of those obtained by Hsiao Ho, but only a mixed lot of general and local maps of the Han period. None of these shows *fên lü* (which temporarily your lecturer will call distances), nor indicate correct orientation; they are incomplete in their record of the famous mountains and great rivers, and though they have a rough configuration they are all imperfect and unreliable; moreover, they use words of wild exaggeration and distortion, inconsistent with facts and unacceptable to common sense." After encomiums to the emperor, he goes on to attribute to him the demand for correct maps of his new territories. All existing maps proving unreliable, P'ei Hsiu says that he proceeded to a study of the geographical descriptions found in the "Tribute of Yü" of the mountains, seas, and water-courses, the highlands, lowlands, slopes and fens, also the nine ancient divisions and the present sixteen divisions, the boundaries and outlying districts of their provinces, states, prefectures, and towns, together with the old names of the places where the ancient states made their treaties or held their assemblies, as well as the various routes by water and by land, and (thus) he made his geographical map in eighteen sections.

Then he lays down his six rules for cartography, which are excellent for the period in which he lived.

1. *Fên lü*, 分率. This is a term already mentioned, and which I shall discuss more in detail presently. Here I will follow Chavannes and style it "rectilinear divisions," and assume for the moment that they were squares on the "grid" principle, "by which," as P'ei Hsiu says, "to define relative location, east and west, north and south."

2. *Chun Wang*, 準望. Orientation, "so as to show correctly the relation of this (place) to that."

3. *Tao li*, 道里. Mileage, or route miles, is the definition I am accepting, but the term might mean "stages." His definition helps us little—"that by which the reckoning of what has been passed may be fixed."

4. *Kao hsia*, 高下. Altitudes, "the high and the low."

5. *Fang hsieh*, 方邪. Right and oblique angles, or bends (in the route).

6. *Yü chih*, 迂直. The curving and the straight.

He goes on to say that the three last show the lie of the land, by which comparison may be made of the ease or difficulty (of the route). On maps without rectilinear division he says there is no means of discovering distance. With such lines, but without correct orientation, though one attains it in one quarter one loses it in another. With orientation, but without "mileage," or "stages," then, commissioned to places cut off from each other by mountain or sea, one could not reach them, etc.

It is P'ei Hsiu who deservedly has the credit of carrying the work of his predecessors up to a scientific standard. If he indeed invented the "grid," as seems probable, then he antedated by centuries the work of the author of our map B, on "The Tribute of Yü." In order to enable you to form an opinion on this interesting question of the invention of the "grid" map, and perhaps add another to the valuable discoveries made by ancient Chinese, let me present such evidence as I have been able to procure, with apologies for its technicality.

There are two terms which require consideration. One is 分率, given by Chavannes as *fên lü*. The other is 廣輪之度, *kuang lun chih tu*, which four characters are P'ei Hsiu's own definition of *fên lü*. First discussing this definition, which Chavannes translates as "the dimensions of the superficies," its literal form is "the degrees of *kuang-lun*," or of the *kuang* and the *lun*. Now what is the meaning of these two words? or what was the meaning? K'ang-hsi's dictionary defines *kuang*, whose normal meaning is "breadth," as, in cartography, "from east to west"; and *lun*, whose normal meaning is "a wheel," or "to revolve," as "from north to south." If these definitions be accepted the meaning would be "degrees (or measurements) east and west, north and south." These "degrees" are of course not meridians, or lines of latitude and longitude in the spherical sense, for they are equal in both directions on the Chinese basis of a flat, four-square world. A difficulty arises as to the correctness of the interpretation of *lun*, which would naturally suggest either the periphery of a map, or the lines of a vehicular route. But if this interpretation were accepted, the "grid" theory would be upset, for the meaning of *fên lü* would then be the distances on the superficies and on the periphery, or on the routes and rivers. The route-distances seem to be indicated in the third law of *tao li*, or "route mileage," if we take *li* to mean miles, and not "places," or "stages," which it does equally mean. In any circumstances our map B has to be accounted for, so that on the whole I am inclined to accept the Chinese definition of *kuang lun* as indicating the lines of the "grid," east and west, north and south. In that case Chavannes' hesitant definition of *fên lü* as "les divisions rectilignes" would be confirmed.

As to the term *fên*, it means "to divide," or "division"; but what is the second character? Should it be pronounced normally as *shuai*, or abnormally as *lû*? If we consider the character in its original form it will appear to throw an interesting light on the question of the "grid." According to Chinese authorities the original form of the character was entirely pictorial. It represented a large-meshed hand-net for catching birds, the strokes protruding at the bottom and the top representing the handle of the net, and the rest the frame and mesh. Here, then, we have a term "net" ("mesh" having already been appropriated) better even than "grid," and if I venture to refer to map B as the "net" map you will understand my reason for so doing. The only difficulty I have is found in the pronunciation of the character. It has two sounds, its normal sound of *shuai*, which probably approximates to its early sound; the other is the sound accepted by Chavannes of *lû*, which is used with the meaning of 約數, defining quantity. I have not been able to make inquiry of any competent Chinese, who would probably be just as dependent on books and tradition as the rest of us. If P'ei Hsiu's pronunciation of the word were *lû* then it might possibly, though not necessarily, tear larger holes in my "bird-net" theory.

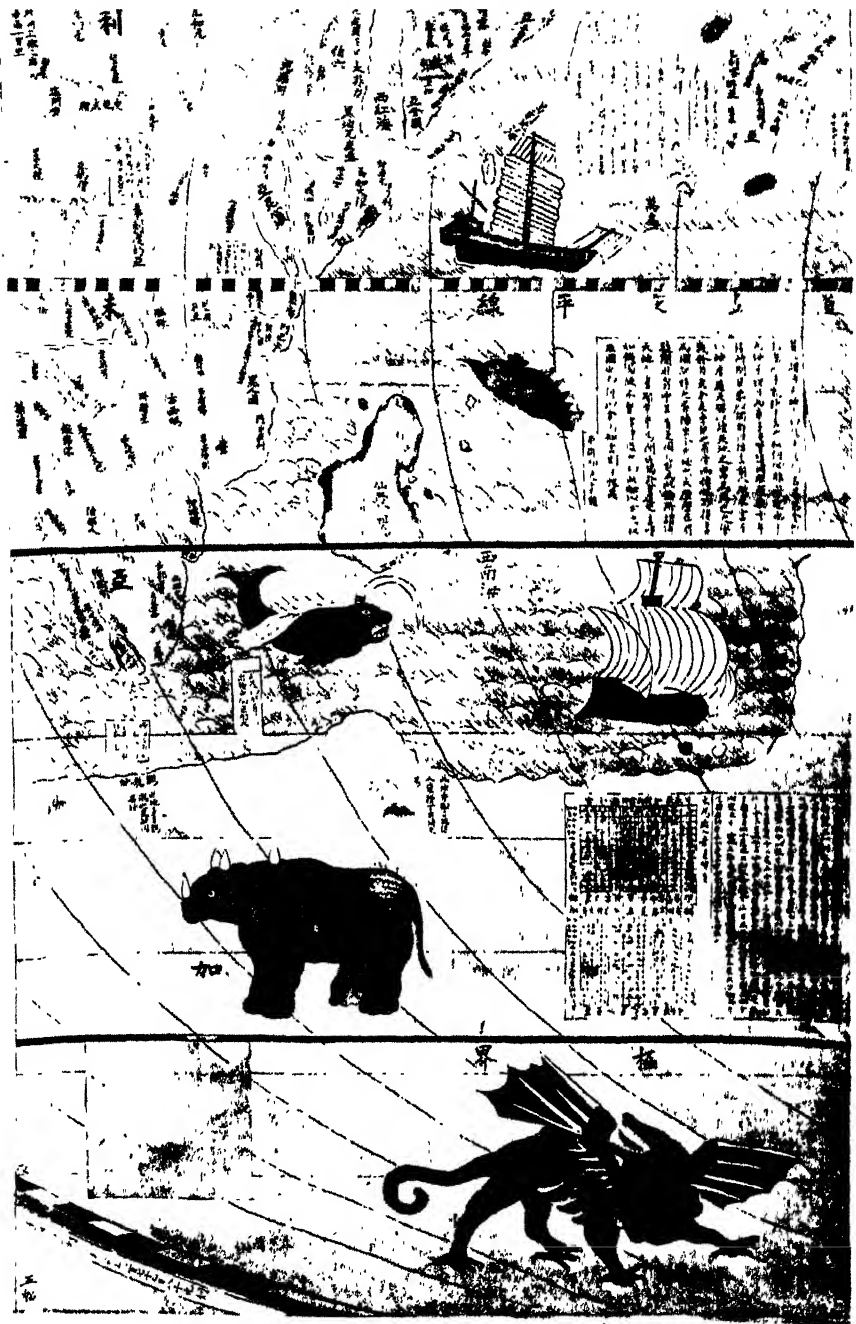
As to the "net," I have already stated that meridians in our sense of the term are not thus indicated, for the indication of meridians of the sphere was unknown in China until Matteo Ricci made his map of the world in Chinese in A.D. 1602. That was the first introduction of spherical projection, but despite Ricci's endeavour his spherical world failed to be adopted and remained unacknowledged by the Chinese down to our own day. They have done remarkable work in many directions, but though there has never been actual arrest in progress, yet in cartography, as in most of the other branches of scientific knowledge, they have still to attain to first rank. They have had no Pythagoras, no Thales, Anaximander, Hecatæus, Pytheas, Eratosthenes, Strabo, or Ptolemy—all of them long before the days of P'ei Hsiu. Nearly three centuries after Ricci the world was still to the Chinese a four-square plane—not even a disc. Seeing, however, that it took a thousand years for Europe to accept the spherical shape of the Earth and to overcome its belief in geocentricity, one need not be unduly surprised at China.

Returning to P'ei Hsiu, we are told by Ch'üan Tsu-wang, *circa* 1736 A.D., that P'ei Hsiu's map was on the scale of 2 inches to 1000 *li*; a *li* is roughly a third of a mile. The source of his information, however, cannot be traced. After P'ei Hsiu, one Hsieh Chuang, 421-466, carved a map on wood 10 feet square. This could be taken to pieces, like a jig-saw puzzle, so that the provinces might be studied separately. In 658 Hsü Ching-tsung, and in 661 Wang Ming-yüan, supplied maps of the western areas, which had been added to the empire after the T'ang emperor had overcome the Turks, territories which stretched from

Tarbagatai to the Indus. A century later, 742-755, Wang Chung-ssü supplied a map of the western regions, showing distances.

None of these maps exists to-day, and Chinese cartography remains with us, thanks almost entirely to the labours of Chia Tan, the famous cartographer of the T'ang dynasty, who lived from A.D. 730-805. It was in 801, when over seventy years of age, that he presented to the throne his *Hai-nei Hua Yi T'u*, or Map of China and Barbary within the (four) Seas. This map was 33 feet high by 30 feet wide, and on the scale of 100 li to the inch. So large a map would therefore describe an area in English miles of about 11,000 miles from north to south and 10,000 miles from east to west. So great an expanse of territory was one about which the Chinese could have, for by far the greater half, but the haziest notion, for it covers nearly half of the globe. Chia Tan is said to have gathered most of his information in regard to foreign countries from tribute bearers and visitors to the capital, so that the map seems to have depended largely on "travellers' tales." His original map is no longer in existence, nor do any copies of the whole exist. I am, however, going to suggest a theory of my own for the consideration especially of Chinese geographers. My suggestion falls into two parts: (1) That our present map A of China and Barbary is in fact that section of Chia Tan's original map which depicted China; and (2) that his map of Barbary, now lost, is represented by the descriptive details written around the map. Chavannes, taking Chia Tan's original scale of 100 li to the inch and applying it to our map A, says our map covers a space of 7300 li north to south and 7000 li east to west. Apparently he has measured the whole stone for these figures, or accepted the squares on the net map. In point of fact, the actual territory shown on map A covers less than 5000 li from north to south and less than 6000 from east to west. In neither of the two maps are the geographical distances accurate, but generally excessive. From this one may discover confirmation of the fact that cartography had no astronomical basis, but was wholly pedestrian.

The date of our map A, China and Barbary, in its present form—that is, as it came from its latest editor—can be fairly accurately known from its own written statements. For instance, it describes the Khitan nation as the 大遼國, *Ta Liao Kuo*, or nation of the Great Liao. The word "Great" clearly indicates that the latest editor lived in that part of Northern China which had been conquered by the Khitans. Chavannes gives exhaustive evidence in favour of the year 1043 as that in which "the author of the map" made it, or, as I prefer to think, revised it and perhaps added the notes. It seems evident that its original was known while the Sung dynasty ruled over the north, that is, before the northern invasion of the Khitans, for the dates given are those of the Sung dynasty, e.g. *Chien-lung* 960-2, *Ch'ien-tê* 963-7, *K'ai-pao* 968-75, *Tuan-kung* 988-9, and last of all the sixth year of *Pao-yüan* 1043. In point of fact, the *Pao-yüan* sixth year never existed, for that period



Part of one of the six panels of the Ricci Map of the World preserved in the Museum of the Imperial Palace at Peking: from a photograph of the whole presented to Professor Soothill, now shown in the Museum of the R.G.S.

beginning in 1038 ended in the following year 1039, but our editor, living in the north-west under the recent conquerors, the Khitans, was unaware that the Sung dynasty had in 1040 changed the *Pao-yüan* period to *K'ang-ting*; he therefore carried *Pao-yüan* forward to the sixth year, that is, 1043. Chavannes gives detailed arguments in justification for fixing 1043 as the date of map A, and though I willingly accept them, I am by no means willing to admit that they fix the date of the map itself, apart from its descriptive matter. How to get back to the original map is the difficulty.

On first studying these maps the line of inquiry which suggested itself as the most suitable for settling the dates of their compilation seemed to present itself in the names of the districts shown on them. And the reason for this consideration was the sweeping alteration in place-names which usually occurs on a change of dynasty. I think there is evidence in the place-names on the map A to justify the dating of it during the T'ang dynasty; in other words, about the period of Chia Tan. But I am not quite confident of this line of proof. In Ricci's map, for instance, we have an interesting instance of the way in which a map can remain essentially the same map in almost everything but a slight alteration of the dynastic title.

This is well shown by the Ricci map. It is with much pleasure that I am able to show photographs of what I take to be the original of Ricci's great map of 1602, made 900 years after Chia Tan's famous Map of China and Barbary. These photographs were presented to me in Peking last year, and this is the first time that they have been seen in this country, or, so far as I know, anywhere outside China. Ricci's map was offered to the emperor towards the end of the Ming dynasty. You will see that it very clearly bears the characters 大明, *Ta Ming*, Great Ming, the name of the then existing dynasty. It was afterwards engraved on wood blocks, without the embellishments of ships and beasts, and a copy in the Society's collection was thought to be of the original edition, until it was found to bear the words 大清, *Ta Ch'ing*, i.e. the Manchu dynasty, which came into existence in 1644 and ended in 1912. Those who desire to know more fully the contents of the map will find them in the *Journal* of October 1917, where Mr. Baddeley and Mr. Heawood have discussed the subject, and in the issues of December 1918 and January 1919, where Dr. Lionel Giles translates the text.

Returning to our two so-called "Chia Tan maps," it is tempting to say offhand that the map A, of China and Barbary, though carved on stone later than the net map, yet is decidedly the older of the two, for it is inconceivable that any cartographer with the net map available would have neglected to correct the coast-line. The net map shows not only the Shantung promontory, which is hardly noted on map A, but also, with the exception of the Chekiang coast, which I happen to know better than any other, it shows the coast-line with far more approximation

to reality than does map A. It is, however, noteworthy that the river system in this, the China and Barbary map, so far as the west is concerned, is superior to that in the net map. Map A also shows the mountain ranges, which are totally absent from the net map. I shall endeavour to account for this omission later, as in my opinion the net map was produced for a purpose quite different from that of Map A.

Referring again to the river systems shown in both maps, it will be noted that in the net map the only south-western river shown is a river marked "Black River Mouth." The Black River joins the Red River near Hanoi, the two having run parallel for about an equal length. But, out of position though it is, Chavannes notes this is the exact location it occupies in the chapters on "The Tribute of Yü." If the theory I shall propound is correct, there is every reason for the river system in the west and the Great Wall in the north being ignored in the net map and receiving much more detailed treatment in the map of China and Barbary. In the west of the latter map is a rough designation of what seem to be the Mekong, Salween, Irawaddy, and perhaps the Ganges rivers. In the north-west also the general detail is greater than in the net map.

It seems to me certain that though these two maps are nowadays attributed to Chia Tan, he cannot have been the cartographer of both. They present all the appearance of having been made by different cartographers at different times, in different localities, and for different reasons. I suggest, therefore, that Map A, China and Barbary, is part of Chia Tan's map completed in A.D. 801, and that it may have been based on P'ei Hsiu's maps of the third century, not directly, but rather on copies which the elaboration of numerous local cartographers, especially towards the west, had made possible; of the existence of these during the T'ang dynasty, 618-907, we have abundant records. I would further support my theory with the evidence which the map gives, as already mentioned, of the importance of the west and north-west. The stress laid upon those regions in Map A seems to be entirely in accordance with their political predominance during the T'ang and pre-T'ang periods, when the coast was far from the capital and of minor importance to the Government. That the north-east should be more fully developed in the net map may be accounted for on similar grounds, inasmuch as the political pressure of the north-east was predominant at a later period. These grounds would, I consider, be sufficient to adjudge the map of China and Barbary as the older map, and therefore the most ancient map of China now extant.

I am inclined to go further and say that not only have we here the China section of his China and Barbary, but that the cartographical representation of Barbary, being of comparatively minor value, has disappeared, leaving only that portion, namely China, which was of special interest to the Chinese. As already stated, Chia Tan had built his map of Barbary on descriptions he received from tribute bearers

and other foreign visitors to the capital, as also from the records of Buddhist pilgrims and other travellers, and therefore, the part relating to Barbary must necessarily have been, for the most part, of a fanciful character. All that is left, therefore, of Chia Tan's Barbary may be the written description of it inscribed around the section of China which, if my surmise is correct, still remains to us. If it were possible to reconstruct Chia Tan's Barbary from that description it would perhaps give us a map of the world as conceived by him in the eighth century.

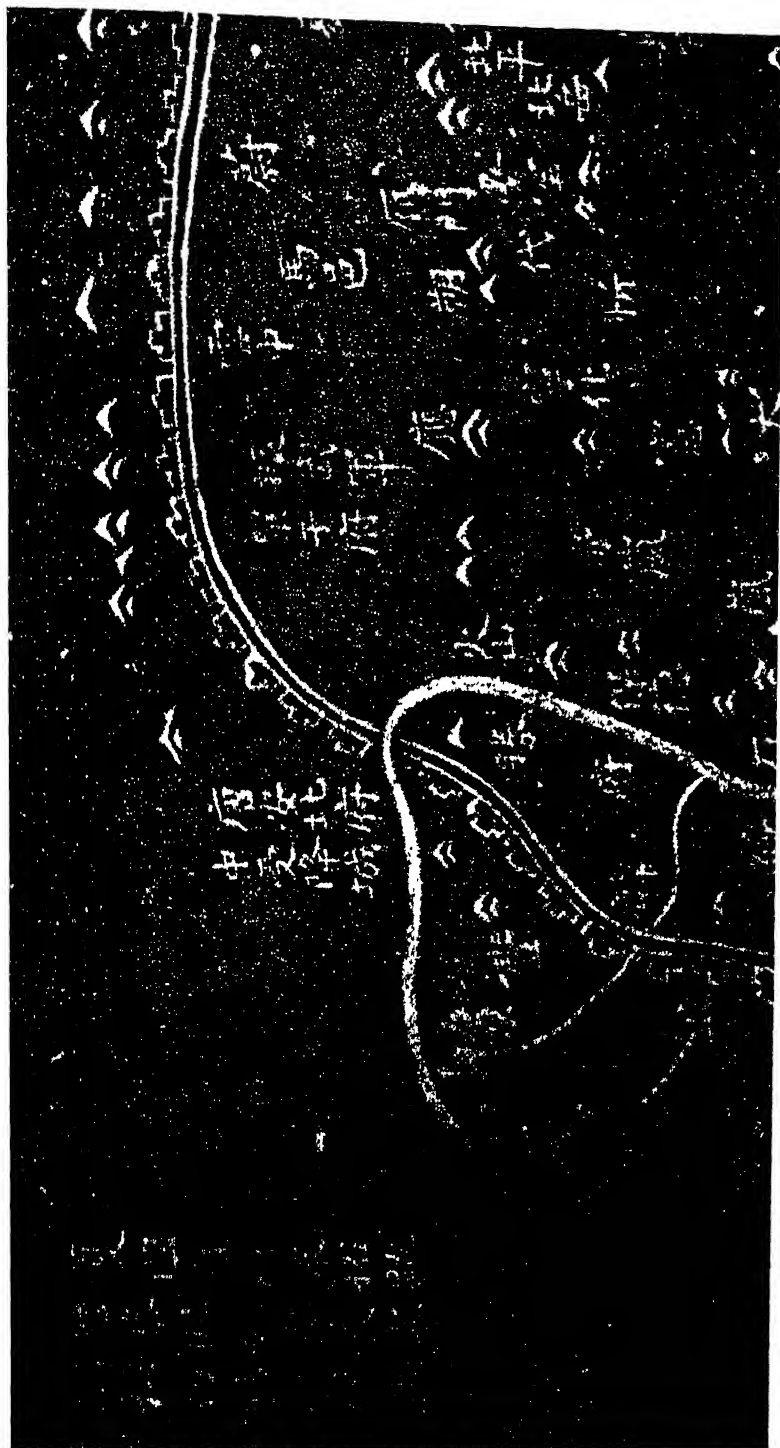
But there are other reasons to account for the disappearance of the Barbary section of the map. First, there were the chaotic internal conditions which resulted from the fall of the T'ang dynasty in 907, and the sixty years or more of civil strife which followed. Again, Chinese political interest was swung from the west and north-west to the east and north-east by the rise of the Khitans and their invasion and conquest of North China. I therefore consider that map A, with possible change of some names, is China as it was known in the eighth century A.D. May I in passing draw attention to the mountain ranges in that map? These ranges are represented with reasonable accuracy, and I think the reason is that they are an essential feature of any map that is required for military and political purposes. It is noticeable that these ranges are not shown on map B, for a reason which I shall now place before you.

Let us turn to an examination of map B, "Map of the Footsteps of Yü." Its title and sub-titles show clearly that it is a map drawn to delineate the territories which paid tribute to the Emperor Yü, the reputed founder in B.C. 2205 of the first Chinese dynasty. The Tribute, or Tributaries, of Yü is the title of one of the chapters of the *Shu Ching*, or "The Book," a work whose authenticity is doubted, but which, at least as early as the first century of our era, was accepted as a genuine record of the pre-Confucian period. At any rate it existed long before the days of P'ei Hsiu, and undoubtedly gave the title to his famous map. It certainly existed for a thousand years before the net map B, and was one of the most important text-books used in higher education and in the public examinations. The importance of this point to our consideration of map B is manifest, inasmuch as the *Yü Kung*, or Yü's Tribute, forms the chief geographical part of the *Shu Ching*. As already stated, before Yü became emperor he had subdued the historic Chinese Flood, and is reputed to have travelled far and wide in China for this purpose. It is quite possible to interpret the title of our map as "The Footsteps or Trail of Yü," that is as found in the "Tribute of Yü," but it probably indicates the tracing of the boundaries of Yü's tributaries. The Tribute of Yü tells us that, having brought the indigenous tribes into subjection, he divided the whole of his territory into nine provinces. fixed the tribute each province was to supply, and set up in his palace nine tripods, one for each province, covered with graphic indications.

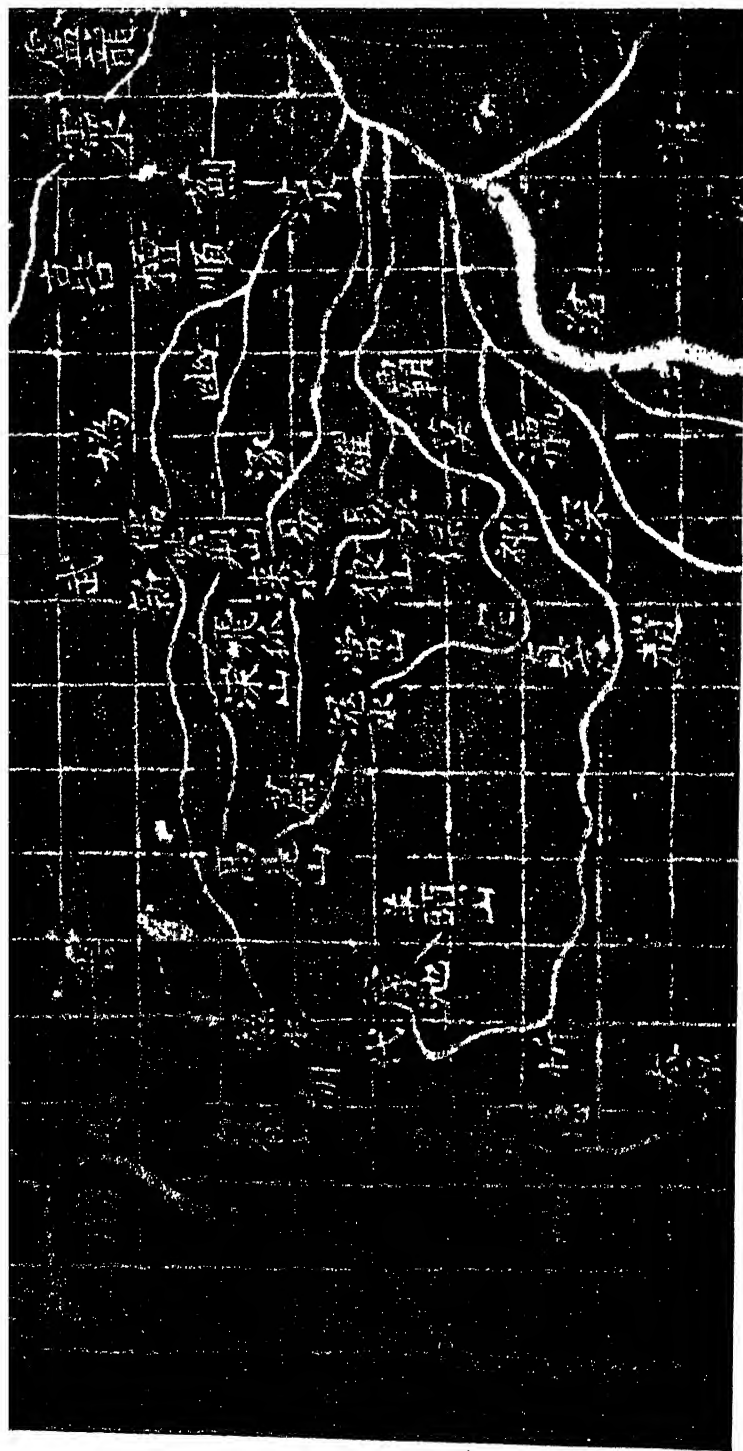
Our map B therefore might be styled a map of the tributary provinces

of the Emperor Yü. This seems to me to account for the absence of the Great Wall, which of course did not exist in Yü's day; as also for the indifferent treatment of the then little-known far west and the still less known south-west. How then does it happen that the Shantung promontory, the east and north, and the coast-line receive so much more attention in this map? My reply is that the map was made after the political orientation had changed from north-west to north-east. It was certainly not the result of a new national survey, but an attempt by some northern cartographer to correct the outline of existing maps of China, aided no doubt by increase of local interest in topography, especially on the part of official administrators. The history of China clearly shows that the Khitans, or Tungus (Tung-hu, or Hsien-pei), had drawn political attention to the north-east. True they were troublesome as early as the seventh century, and continued their profitable raids from time to time, but at that period they were a nuisance rather than a political menace. It was only after they had settled in the Liao-tung Peninsula that they became an aggressive factor. The end of the tenth century saw the serious struggle begin between the native Sung dynasty and the Khitans of the north-east, a struggle which continued with bitterness and huge territorial loss to the Chinese dynasty until the rise of the relatives and former dependants of the Khitans, namely the Kins. In 1125, under Akuta, the Kins overcame the Khitans, proceeded to invade China, and by 1127 had mastered most of China north of the Yangtsze, and driven the Sung rulers over that river, which they never again effectively crossed, for during the following, the thirteenth, century the conquering Mongols destroyed both Kin and Sung and conquered all China, as also most of Asia.

It was early in the Kin rule, or rather in that of a Chinese king reigning by their appointment and subject to them, that our two maps were carved on stone. Map A was carved, according to its own statement, in the fourth month of 1137, in the official college at Ch'i-shan in Fêng-hsiang-fu, 120 miles west of Hsi-an, the provincial capital of Shensi. As to Map B, whose date of engraving is six months earlier, Chavannes reasonably surmises that it was engraved in the same college. Now it is my opinion that this Map B of the Tributaries of Yü was made and used entirely for pedagogical purposes, its object being solely to enable students preparing for examination to visualize and understand the geography of the chapter on this subject in the Classic of Ancient History. Nor do I depend for this opinion on a mere surmise that the stone was carved in the college at Ch'i-shan. We have further confirmation in Chinkiang, the Guardian of the Yangtsze's mouth, where a stone map of exactly the same dimensions as that of our map B was made in 1142, not by an ordinary administrative official, but by the Prefectural Director of Studies. This map was not, however, made from our map B, but from a common original. At any rate, its being carved by the Director of Studies lends



A portion (full size) of Map A, "The Map of China and Barbary," engraved in A.D. 1137, but probably based upon Chia Tan's map of A.D. 801. From a rubbing of the engraved stone tablet at Hsianfu, measuring 30½ inches square. The plate shows the Great Wall crossing the Hwang Ho below Paotehchow



A portion (full size) of Map B (the net map):—"The Map of the footsteps (or tribute) of Yü" cut in the seventh year of Fou Ch'ang (A.D. 1137), but probably based on a reconstruction of P'ei Hsiu's map made A.D. 800-1100. From a rubbing of the engraved stone tablet at Hsianfu, measuring $30\frac{1}{2} \times 31$ inches. The plate shows country between the bend of the Hwang-Ho shown in A and its mouth in the Gulf of Pechihli

colour to my suggestion that the map was for educational and not for administrative or military purposes. Further confirmation may be adduced from the contents of the map itself, for instance, the placing of the Black Water River as the only one in the south-west, which, as Chavannes indicates, is exactly the place where it is shown in the chapter on the Tribute of Yü. If, then, my conviction that map A of China and Barbary is much the older, then its more extensive representation of the western river system, as also of the Great Wall and other features, cannot have been unknown to the maker of map B, but I consider that he deliberately limited himself to his historical subject, while using all the increase in cartographical knowledge which had taken place eastwards since the days of map A. I may add that map A, with its wealth of historical detail, was also undoubtedly engraved, in its present form, for educational purposes in Chinese history, but this in no way invalidates my theory as to its real origin.

A question which puzzles me is: If the *fên lü*, or *fên shuai*, that is, the mesh lines of P'ei Hsiu on his third-century map of the Tribute of Yü, were really drawn 1000 li to the 2-inch square, how is it we do not find similar squares on what I am calling Chia Tan's map A, while we do find them 100 li to the inch on map B of Yü's Footsteps? Now there can be no doubt that our net map is the oldest existing map with a grid in China, perhaps in the world. Is it possible that it is P'ei Hsiu's third-century map of The Tribute of Yü, or at any rate based on his map, reduced in size and corrected according to later research; or is it a more or less original map founded on tradition, or on records and on the rules laid down by him? It must always be borne in mind that we have no reliable evidence of the scale of P'ei Hsiu's map, for the only known witness is Ch'üan Tsu-wang of the eighteenth century, 1500 years later. At any rate we have here two maps, known by titles already existing. Map A is engraved with the name given by Chia Tan to his great "Map of China and Barbary," and I suggest that our map is the section of his map which related to China, the Barbary portion, by an irony of fate, for it was Chia Tan's chief interest, having been reduced from his cartographical to a mere written description. I do not accept the view of certain Chinese writers that his map has been shrunk to a tenth of its original size, but rather that the main part is lost. His map was made definitely for political and military purposes, and it is not impossible that in map A we have the drawing and scale of the China section as he produced it. As to the map B, it has a similar title to that of P'ei Hsiu of the third century A.D. Now we are told that P'ei Hsiu's map had disappeared long before Chia Tan's day. It is therefore practically certain that this map is not P'ei Hsiu's. Again, as already stated, it is extremely unlikely that Chia Tan drew maps so different in configuration as maps A and B. I am, therefore, far more inclined to think that map B was drawn by an unknown cartographer on P'ei Hsiu's

net system, sometime during the three hundred years which elapsed between Chia Tan's death and A.D. 1100. It seems apparent that it was an endeavour, seven hundred years later, to reconstruct P'ei Hsiu's map, or rather to construct an up-to-date map on his principles, and for a similar purpose, that is to say, to illuminate the reputed ancient *Shu Ching*, or Classic of History.

One is tempted to think that Chia Tan's work stimulated such an interest in cartography that the Provincial officers, not least the coast officials, began to make maps of their provinces, and even to reproduce them, for block printing began at least as early as the tenth century. At any rate, we have clear evidence that cartography received much attention, especially during the T'ang period 618-907. And it may be taken for granted that no one cartographer, or company of cartographers, at any one period had surveyed and mapped the whole coast, or any other part of China. What may be justly assumed is that from P'ei Hsiu's day onward crude maps were from time to time produced, especially where political or military exigencies required them. Nor is this mere speculation, for we have it on record that numerous maps were made even before the T'ang dynasty, namely between 300 and 600 A.D., which are said to have disappeared during civil war. Such total disappearance is doubtful, for under the short-lived Sui dynasty, 589-618, we have a note of the existence of old local maps, undoubtedly genuine maps; and under the succeeding T'ang dynasty 618-907, the titles of many others are given. I again draw attention to this fact and make the inference that our two maps of China were synthetic productions of two separate individuals who had other maps at their disposal. I believe, therefore, that map A is Chia Tan's; map B the product of a later unknown cartographer who adopted P'ei Hsiu's principles, but with configuration corrected by knowledge acquired after Chia Tan's date 802.

In conclusion, let me say that the general ignorance of the history of Chinese cartography is seen by the fact that Père Richard's standard work on the Geography of China makes no reference to the subject, or any mention whatever either of the name of P'ei Hsiu, or of that of Chia Tan. As to that useful work the *Encyclopædia Sinica*, it dismisses the whole subject with the words: "The Chinese map is crude and incorrect. China itself is drawn of a shape to suit the map, the provincial boundaries are most roughly given, mountains and rivers seem added from fancy." Neither of these works is twenty years old. But I think you will agree with me that there was as much cause for pride in the production of maps A and B, and not least in their being engraved with such care and exactitude on stone, as in the maps made by Europeans hundreds of years later. They are apparently the oldest maps on stone in the world, and the maps of which they are copies are probably the oldest and most accurate maps of which we have any knowledge. Nevertheless, both then and for a thousand years longer the Chinese continued to live on a

flat, four-square earth, and had no glimmer of such superior scientific knowledge as that shown in his disc-shaped map by Hecataeus, the successor of Anaximander, as early as B.C. 500 ; or of Strabo's map in A.D. 19 ; still less of Ptolemy's world-map of A.D. 150. In cartography, as in many other subjects, the Chinese tree of knowledge was rooted in China and benefited little from cross-fertilization. If we in the west have the advantage of a knowledge more ancient, more deeply rooted, and better developed by a cross-fertilization unknown to China, that is our good fortune ; in my opinion both civilizations give promise of a larger future by the cultural benefits they will receive from their closer intercourse. May the present period of political unrest soon pass, so that we can settle down to one of mutual rivalry for the charm of life rather than in the sordidness of mutual strife !

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said : I have the pleasant task of introducing to you the Professor of Chinese at Oxford, Professor Soothill. It is not because he is Professor of Chinese in my own University but by the common consent of the world that I introduce him as one of those who have known all that is known about the subject of Chinese cartography. Another was the late Sir Alexander Hosie. You will have the opportunity of listening this afternoon to a discourse which will yield nothing in respect of learning to any discourse in any other capital of Europe. I ask Professor Soothill to address you.

Professor Soothill then read the paper printed above, and a discussion followed.

Mr. E. HEAWOOD : I feel some hesitation in speaking on a subject that can really be properly dealt with only by Chinese scholars. I can only say how pleased I am as a student of early maps to have heard the information about those Chinese maps put before us so clearly. I cannot help feeling a certain personal interest in the paper, because I believe it was I who first suggested to Colonel Mills that the maps should be submitted to Sir Alexander Hosie, and I am pleased that the suggestion has borne such good fruit. I also cannot help wishing that Sir Thomas Wade, the first Professor of Chinese at Cambridge, had survived to hear these maps so well discussed, because I remember a conversation with him almost forty years ago in which he urged the study of early Chinese geographers, and said how sure he felt that the study would well repay all the time that was given to it. He even thought that we in our own time might gain some actual knowledge of the topography of distant parts of China from the study of the ancient Chinese geographers. It certainly seems a remarkable thing that the Chinese should have succeeded in making such excellent maps without any use of astronomy. The maps seem superior in many ways to Ptolemy's maps of even the regions best known to him—for instance, in the correctness of the course of the rivers, and so on. Professor Soothill said that the exaggeration of distances shows that there was no astronomical basis, but surely that alone would not prove it definitely, for we get the same exaggeration in Ptolemy's maps. His length of the Mediterranean was very unduly extended, and yet, as we know, his maps were constructed by an astronomical method. All would, in fact, depend on the degree of accuracy with which the length of a degree could be determined. But no doubt there are other good grounds

for saying that the maps were constructed by the help of pedestrian methods only.

Professor Soothill spoke of the Ricci maps, and of course I am very much interested in the discovery of the hand-drawn map of Ricci which seems to be the original of the map preserved in the Society's collection. But I was not quite clear whether there is any definite proof that it was made in 1602. Is that date to be found on the map itself? We must remember that Ricci made two earlier maps, one in 1584 and another about 1599. Does Professor Soothill consider it quite impossible that the map which we saw on the screen was the original of one or other of them? Probably they really were smaller maps.

There is one side of the subject I should like to see gone into rather more fully, and that is the comparison of early Chinese map-making with that prevailing elsewhere about the same period. There were not only Ptolemy's maps, but Arab maps. In the ninth century the Caliph Al Mamun appointed a Commission of experts to compile a series of maps, which seem to have been a revised and extended version of Ptolemy's, and this would be almost contemporaneous with the making of the originals of these maps preserved to us on stone. It seems very remarkable that the knowledge of the Arabs in regard to other parts of the world should not have spread to China at all, seeing that we know that in the eighth and ninth centuries Arab voyages to China were made. Yet apparently there was no interaction whatever between the two foci of cartographical evolution. In conclusion, I can only express my pleasure at listening to what Professor Soothill has put before us.

Lady HOSIE: It is with great trepidation that I address such a learned audience, but I am very grateful to my father for finishing the work that my husband commenced at Mr. Heawood's suggestion. When Colonel Dudley Mills sent the maps, the late Mr. E. H. Parker, Professor of Chinese at Liverpool University, urged my husband to undertake the work. His chief task was to translate the Chinese characters into our Roman lettering. He felt there was a great deal to be done on these two maps, and knew that he could not spare the time to do it all himself. He thought that if he put Roman characters, those who did not know Chinese would be able to work from them. My husband had various ideas about the maps, having just finished making his own map of China. Knowing that at the end of dynasties names of Chinese cities are often changed, he thought he could perhaps date the originals, from which the maps were carved on the stones, by a study of the place-names appearing on them. My father suggests that one of the maps by this test probably belongs to the T'ang Dynasty, and the other is a little later. One of my husband's theories was that the maps were not maps of the cities of China but of the administrative areas. For instance, Chung King, which is on the Yangtze, is built where the Yangtze takes a bend, so that it is up a hillside on a promontory, almost surrounded by water. But on the older map it is shown somewhat inland. In the same way, Canton, the city, is actually on the West River delta, but in the old maps it is also put a little inland. Thus my husband came to the conclusion that the maps were not maps of actual cities but of administrative areas, since maps were originally made for the Emperor and for administrative purposes. This theory was endorsed by Dr. Hu Shih, the Chinese scholar, a Professor at the National University, Peking, when he was lately in England and saw the maps.

My father has not had time to tell you the meaning of the notes at the side of the map, but they are extraordinarily interesting. There are seventy-four nations to the north, and a great number to the east, which are named on the

"Map of China and Barbary." The notes have been translated by him into English so that the general public can read them. One that interested me was in regard to the "Kingdom of Women," which is said to be 5000 li east of Korea. To the north is the "Kingdom of the Wandering Demons," and so on. The source of the Yellow River is also referred to in some of these notes. Except that it flowed through the K'unlun Mountains, the initial course of the Yellow River was for long a great puzzle to Chinese geographers and cartographers. I always remember a Chinese teacher who told me that the source of the Yellow River was the River of Stars, the Milky Way, which bends down to the Earth. That is not, however, stated on the maps; they are much more scientific and place the actual source of the Yellow River in Tibet.

General Sir EDMUND BARROW: What does the lecturer mean when he speaks of China and Barbary?

Professor SOOTHILL: That is an interpretation of my own. The map itself uses the word *yi*, which has generally been translated "barbarian." I have used the term to indicate that China was the one civilized country and all the rest were barbarian kingdoms. The latter I cut down to Barbary, thinking the term would be understood.

The PRESIDENT: I think the word "Barbary" was used in the sense in which it was used by the Ancient Greeks and is still used by the modern Greeks. When I lived in Athens and the Greeks were annoyed with certain western countries, the gates of the Acropolis were ordered to be closed to the "Barbarians," by which was meant all other nations of the world. Would Professor Soothill tell us when the Chinese accepted the sphericity of the world? I dare say it is not entirely accepted even now any more than we have given up geocentricity in practice, whatever we have done in theory.

Professor SOOTHILL: One regret I have is that my daughter did not give the lecture instead of myself. She would not have been so profound, but much more interesting. As to the question put by the President, the spherical nature of the Earth has been recognized by the Chinese officially, I think, only during the last twenty-five or thirty years, prior to which, so far as I know, there was no recognition of it whatever, the Earth remaining a four-square Earth. Most of the time I spent in China it was usually expressed in that form, the people believing the Earth to be flat; and my daughter could tell you of the difficulty she has had in inducing Chinese girls and women to believe the Earth is not flat.

As to the Ricci map, all I can say is that it was given to me at the Palace, and I was told that the original map is still in existence there. I cannot tell you at the moment whether the date is on the map itself or not, but I will look that up and let Mr. Heawood know. I have little doubt that it is the actual map that was presented by Ricci to the Emperor Wan Li in 1602, and which was accepted by him.

[Professor Soothill then described the maps in fuller detail, remarking that the net map was more recent than the other (Chia Tan's), and pointing out how well it showed the Shantung promontory. The whole of the coast-line was more accurate and the river system reasonably so. He thought the accuracy of the coast-line arose from the fact that the eastern part of China had become better known, because political pressure at the time the map was made was from the north-east, whereas formerly it had been from the north-west. If the map was made before 802 the centre of government would have been in Western China.]

In Chia Tan's map there was very little sign of the Shantung promontory

but whereas on the net map no mountains were shown, the various ranges were fairly accurately marked in Chia Tan's map. He considered that the descriptive material was of places that appeared on the original map, with the difference that a very large portion was given over to historical geography descriptive of what happened in each particular district throughout the various dynasties of China up to the T'ang Dynasty. Lists at the sides of the map named over seventy western nations, between forty and fifty southern nations, whilst in the map itself were many descriptions of the various tribes living in China; altogether, a remarkable summary of the history of the various internal and neighbouring races and of the periods when expeditions were made abroad.

Professor Soothill thought the original Chia Tan map was completed in 802, though the copy of the original was not engraved on stone until 1137.

In conclusion, the lecturer showed the copy of Ricci's map of the world found in the Palace at Peking and made in six sections. The animals were in the original map, but he did not know of any other maps in China which had animals on them.]

Mr. HINKS pointed out that it was generally thought that Ricci got his map from Ortelius and that the Chinese animals were versions of the originals in Ortelius, and with this Professor Soothill agreed.

General Sir EDMUND BARROW thought it should be possible to date the map by the ship shown on it, and Mr. LAIRD CLOWES expressed the opinion that the ship might represent one of any time before 1600, though probably after 1550.

The PRESIDENT: When you turn to the *Journal* to find Professor Soothill's paper you will read a great deal that he has not had time to tell us this afternoon. But from what he has given us you will be able to judge of the advantage in prospect of reading a fuller account, and particularly the notes of Professor Chavannes upon the lettering round the maps. I do not pretend to know anything about this subject. I have been carried away into a world as unknown to me as the planet Mars, and been impressed more than ever by the extraordinary mutual isolation in which the two ends of the Old World have lived for so long. I asked my question with regard to the sphericity of the Earth because you will notice in the room a celestial and terrestrial globe of Chinese work of about the end of the seventeenth century, made, to some extent, under European influence. Then, at any rate, whether they believed in sphericity or not, the Chinese made a concession to our weakness in representing the Earth as round. No one I know of has ever explained that isolation of China except Professor Myres, who contends that primæval ice projecting far down into the Western world divided it for long ages into two parts as effectually as the Earth is cut off from the Moon. Therefore we have this remarkable phenomenon of a civilization bred altogether in isolation, advancing alone in certain ways to great heights, and not until a very late period experiencing any kind of cross-fertilization from outside, not perhaps until a period when it was so stereotyped and so sure of itself that to a great extent it resisted those cross-fertilizing influences which we Western people, though stubborn, have accepted. However, it is not for me to keep you with remarks of this kind. I am sure I am expressing the sense of you all in thanking Professor Soothill for an extraordinarily interesting paper. He showed considerable self-restraint and self-denial in cutting out as much as he did and depriving himself of the pleasure of expounding it. But it will appear in the *Journal*, and I am sure we owe him our great gratitude for what he has told us.

Note. Since Professor Soothill's paper was read we have received from him his translation of the Geographical and Historical Notes on the Map of China and Tartary. Had it been possible to publish in the *Journal* complete reproductions of Maps A and B, with the transliteration of their names by the late Sir Alexander Hosie, we should necessarily have printed these translations also. But since reproduction must be reserved for a future part of the Reproductions of Early Engraved Maps, it seems best to reserve also the Notes for a memoir accompanying the maps.—[ED. G. F.]

CAPTAIN COOK'S SHIPS

IN the "Additional Note on Cook's ships, the *Resolution* and *Adventure*," dealing with Francis Holman's painting, which Mr. G. S. Laird Clowes added to his paper in the *Journal* for March last, he stated that previous to the discovery of this painting "the appearance of the ships was known only by small and none too illuminating sketches." The Hydrographer to the Navy has pointed out, however, that there exists in the Admiralty Library a large and detailed drawing, $58\frac{1}{2} \times 23$ inches, hitherto unpublished, showing the *Resolution* and *Discovery* at anchor in Nootka Sound, made by J. Webber, who accompanied Cook's last expedition. We are indebted to the Admiralty for permission to reproduce a part of it in the plate facing p. 556: and a photograph of the whole drawing is now hung in the Society's House with other pictures relating to Cook. The Hydrographer also sent a list of the sketches of the *Discovery*, *Endeavour*, *Resolution*, and *Adventure* which appear in the official accounts of the voyages, and of the original drawings preserved at the Admiralty. This comprehensive list is printed below for reference.

Mr. Laird Clowes, in the same note, further described the *Resolution* as being shown "just about to drop her anchor." The Hydrographer disagrees with this statement, and also with the subsequent detailed remarks as to the evolutions being performed by that ship and by the *Adventure*. He considers that the indications given in the picture are entirely in accordance with the supposition that both ships have just got under way; not at all with the theory that one has anchored and that the other is about to do so. Mr. Laird Clowes accepts this correction: his note was based upon the supposition that the small yacht was being brought to alongside the *Endeavour*, rather than that it was standing across her bows as she was getting under way.

The ensign of the yacht bears the following coat: Argent, a bend sable charged with three owls gardant argent. Crest: an owl gardant argent. We are indebted to the Chester Herald, Mr. J. D. Heaton-Armstrong, for the information that these were the arms of a family of Savile or Saville. Following up this clue, the Hydrographer identifies the yacht as the property of Sir George Savile, Bart., F.R.S. (1726-84).

Savile, a wealthy man and a prominent politician, was Vice-President of the Society of Arts and Sciences at the sailing of the expedition, and though not himself a Yorkshire man, represented Yorkshire constituencies from 1759 to 1793. These facts would account for his interest in Cook's expeditions. Previously, but for a reference in Mr. Kitson's life of Cook based upon a document which cannot now be traced, Sir George Savile's name had not been associated with Cook's.

List of Original Drawings of Captain Cook's Ships preserved in the Department of the Director of Naval Construction, Admiralty.

Endeavour.

Sheer draught, with dimensions of spars, etc.

Deck plan.

Resolution.

Sheer draught.

Deck plan.

Adventure.

Deck plan only.

Discovery.

No drawings of this ship appear to have been preserved.

List of the Engravings of Captain Cook's Ships appearing in the Published Official Accounts of his Three Voyages.

First voyage in H.M.S. "Endeavour Bark."

'An account of the Voyages undertaken by Byron, Wallis, Carteret and Cook.' (Edited by Dr. Hawkesworth.) 1773.

Vol. II, Plate 2 (opposite p. 80).

Small incidental representation of *Endeavour* in background, masthead height about 2 inches.

Vol. III, Plate 19 (opposite p. 557).

Engraving of *Endeavour* ashore in Endeavour River, masthead height about 3 inches.

Second Voyage, in H.M. Ships "Resolution" and "Adventure."

'Voyage toward the South Pole and round the World . . . by James Cook. 1777.'

Vol. I, Plate XXX.

"The Ice Islands. . . ."

View of *Resolution*, masthead height about $3\frac{1}{2}$ inches.
Plate LIV.

"The Landing at Middleburgh. . . ."

View of both ships in background, masthead height of *Resolution* about 2 inches.

Vol. II, Plate LIX.

"The Landing at Tanna. . . ."

View of *Resolution* in background, masthead height about $7\frac{1}{2}$ inches.



H.M. Ships "Resolution" and "Discovery" anchored in Resolution Cove, Nootka Sound, Vancouver Island, from the drawing in pen and wash by Webber, in the Library of the Admiralty

Reproduced by permission of the Admiralty

Third Voyage, in H.M. Ships "Resolution" and "Discovery."

'Voyage to the Pacific Ocean . . . by Capt. James Cook and
Capt. James King.' 1784.

Vol. I.

Plate IV. "A View of Christmas Harbour. . . ."

Small view of both ships, roughly broadside on. Masthead
heights, *R.* 2 inches, *D.* 1·3 inches.

Vol. II.

Plate XXXI. "A View of Huaheine."

Small view of both ships, broadside on. Masthead heights,
R. 2 inches, *D.* 1·2 inches.

Plate XLV. "A View of Snug Corner Cove . . ."

Small broadside view of both ships (almost too dark to be
made out). Masthead heights, *R.* 0·8 inch, *D.* 0·5 inch.

Plate LII. "Sea Horses."

View of both ships, bows on and without much detail.
Masthead heights, *R.* 1·3 inches, *D.* 0·8 inch.

Vol. III.

Plate LXVIII. "A View of Karakakooa."

View of both ships, broadside on. Masthead heights, *R.*
2·3 inches, *D.* 1·5 inches.

Plate LXXIV. "A View of the Town and Harbour of St. Peter
and St. Paul."

Very small view of both ships, broadside on. Masthead
heights, *R.* 0·5 inch, *D.* 0·4 inch.

These larger plates are usually bound in a separate folio volume,
and may easily be overlooked.

A GRAPHICAL DISCUSSION OF THE FIGURE OF THE EARTH

Arthur R. Hinks, C.B.E., F.R.S., Sec. R.G.S.

Read at the Afternoon Meeting of the Society, 28 March 1927.

IN a paper read to this Society on the afternoon of 12 May 1924 Captain McCaw gave a summary of the analytical methods of determining the figure of the Earth (*Geogr. Journ.*, August 1924, 64, 120), which makes it quite unnecessary for me to say anything to-day on the classical side of the question. I shall confine myself to describing the outcome of a suggestion which I made in the course of the discussion which followed that paper.

Captain McCaw had referred to the large amount of geodetic triangulation which has never been utilized for the calculation of the Earth's figure, and added that the failure to use all this material is not surprising if it is realized that the labour of incorporating it all in a comprehensive

solution would consume great part of a lifetime. It appeared to me however that if certain geodetic tables on a new plan were calculated, it would be easy to make a graphical adjustment of arcs calculated on any one figure and thus compare them with any other figure, thence deducing pretty accurately the contribution which any arc would make to a general solution for the figure of the Earth.

The most important of the new tables was to be a table of the lengths of the meridian arcs from the equator to each ten minutes of latitude, with the effect upon these lengths of a change of one per cent. in the value adopted for the reciprocal of the flattening. It is singular that no general table of meridian arcs had ever been calculated on any figure. Bessel had done it for a few degrees, and the Geodetic Survey of South Africa for a few more, on a different figure;* but there was no general table on any figure, and nothing to show how small or great were the differences in the same arcs computed with different values of the flattening.

Soon after the meeting at which this proposal was made it became possible to undertake the construction of these tables. Captain McCaw put together the necessary formulæ; the Government Grant Fund of the Royal Society shared with our Society the cost of the calculations, which with the kind assent of the Astronomer Royal were undertaken by two computers of the Royal Observatory under the superintendence of Dr. Jackson. For reasons which are fully explained in the report of the discussion on Captain McCaw's paper, Clarke's figure of 1880 was chosen as the basis of the tables, and in a few weeks the Table of Meridian Arcs was in print, with the variations arising from changes of one and of two per cent. in the flattening.

Meanwhile with the assistance of Mr. Jolly of the Ordnance Survey the figures for the discordances "Geodetic minus Astronomical latitude" were dug out of the principal discussions, and a rapid graphical examination of the results was prepared for submission to the meeting of the International Union of Geodesy and Geophysics at Madrid. In a brief memorandum, supported with four large diagrams beautifully reproduced at the last moment by the kind co-operation of Colonel Winterbotham, I demonstrated to my own satisfaction, but not apparently to that of any one else, that Clarke's figure of 1880 represented the principal meridian arcs at least as well as did any other. The method by which Hayford's figure of 1910 was adopted by the Madrid meetings as the Standard figure for international use has been described in the *Journal* for December 1924, 64, 477. It will be sufficient to say here that not even a single one of my colleagues in the British delegation could be induced by the most eloquent diagrams to make a fight for Clarke 1880. They allowed without dissent the adoption of $1/297.0$ for the flattening,

* Väisälä also had recently included such a table in his Geodetic Tables on Hayford's Figure for the latitudes of Finland, 59° to 71° (Veröff. des Finnischen Geod. Inst. Helsinki, 1923).

and were beaten by a narrow majority of those voting, on a proposal to adopt a round figure for the radius of the equator, as against Hayford's value 6,378,388 metres.

It may well be asked why, in the face of this failure, the New Geodetic Tables for Clarke's Figure of 1880 have since been completed, and are soon to be published as Number 4 of the R.G.S. Technical Series. The following seem to me to be sufficient reasons :

The tables of Meridian Arcs, and of the logarithms of the Radii of Curvature functions, are furnished each with a column showing the effect of a one-per-cent. change in the reciprocal of the flattening, so that it is very simple to deduce the corresponding quantities for any figure within the bounds of possibility. In the original form, as circulated at Madrid, these differences were given for changes of one and of two per cent., because it was found that they were not quite sufficiently proportional to the change of flattening to allow of simple interpolation. More or less by accident, however, it was found later that the change for two per cent. had a constant ratio of 1.9804 to the change for one per cent., and that this was exactly the same as the ratio of the corresponding n 's, where $n = (a - b)/(a + b)$. This proved to be true to a much higher degree of accuracy than one would have expected from the form of the expressions for the quantities tabulated, and allowed a much more precise transformation from one figure to another, so that it was worth while to calculate the one per cent. difference to more decimal places, while abolishing as no longer necessary the two per cent. column.

It is shown by many examples in the Introduction to the Tables that we may transform from one Figure to another with an accuracy of about a unit in the ninth significant figure. Incidentally the principal published geodetic tables were thus compared and verified ; and finally the whole of the tables calculated for Clarke 1880 were transformed to Hayford 1910, or Madrid 1924 as it may be convenient to call it in future, to mark its international status.

The published tables include therefore the values of the meridian arcs and of Log M, Log N, and Log O for Clarke 1880, with their first differences ; the change for a variation of one per cent. in the reciprocal of the flattening ; and the values of the same quantities for Madrid 1924. The introduction gives a table of the factors to transform to any other of the principal figures.

This is perhaps a sufficient explanation why the original project has been pursued, with important improvements and additions. But there are other reasons.

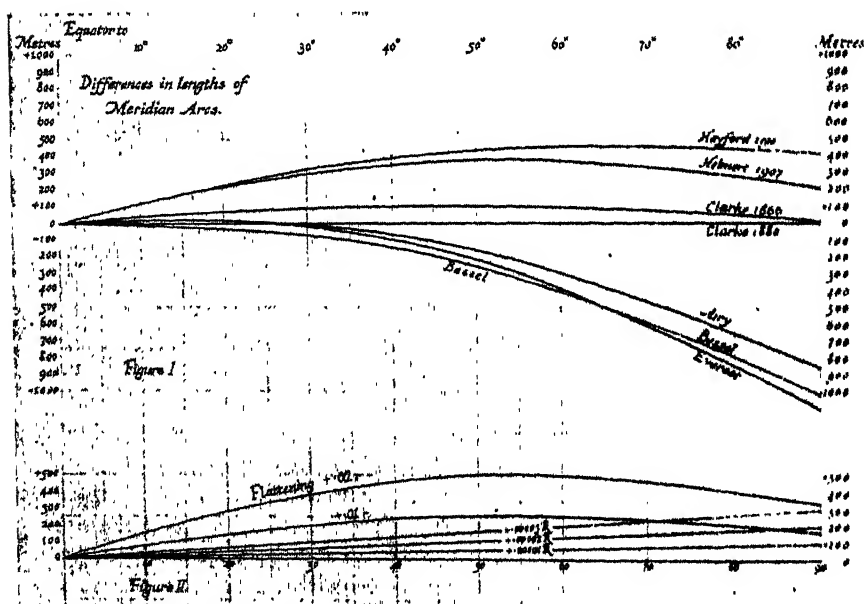
Further study of the problem has confirmed my belief that there is a good case for each of the following propositions which were enunciated at Madrid :

A. Meridian arcs in low or in middle latitudes cannot distinguish between errors in the radius vector and errors in the flattening. The critical arcs are those between latitudes 40° and 70° .

B. The only arcs which satisfy these conditions approximately are the Franco-British and the Russo-Scandinavian, and neither of these gives any clear evidence against the figures of Clarke 1880.

C. There is distinct evidence of some deep-seated disturbing cause which distorts the geoid in latitudes $\pm 30^\circ$ to 20° , and must be further investigated before we can be sure that the meridian sections of the geoid are sensibly ellipses.

The preliminary communication on these matters made at Madrid



I. Differences of lengths of Meridian Arcs calculated on the principal Figures of the Earth

II. Effects of changes in Radius and Flattening

will eventually be published in the *Travaux* of the Section of Geodesy. But since the next meeting of the Union is in sight, it may be well to give the evidence briefly here, and to add some further propositions for discussion.

D. The isostatic calculations of Dr. Heiskanen for the European arcs tend to confirm the conclusion that Clarke 1880 is a better figure for Europe than Madrid 1924, but show at the same time that the observed astronomical latitudes on these European arcs are quite insufficient to give any certain result.

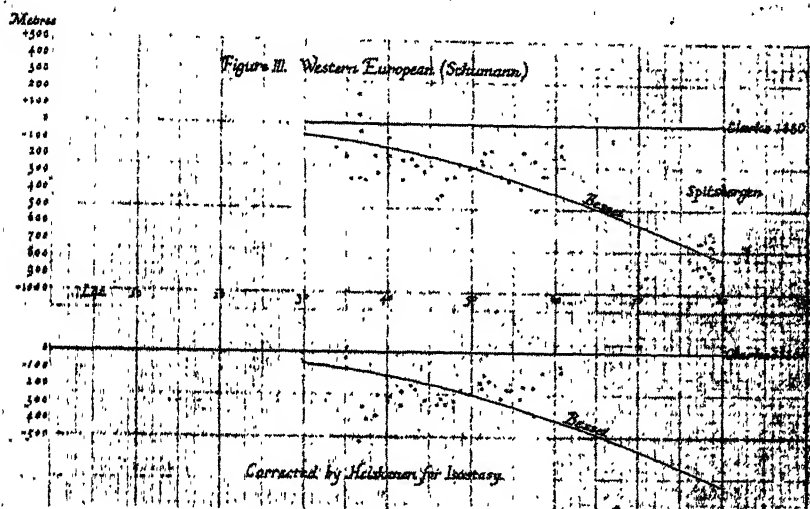
E. A similar graphical process can be used to discuss the gravity

determinations, and confirms Dr. Heiskanen's conclusion that the effective flattening is different in different longitudes, while casting doubt on the efficacy of his longitude term to represent the difference.

F. The most effective immediate contribution to the problem would be an extensive determination of astronomical latitudes at or about the stations of the Franco-British and Russo-Scandinavian arcs.

G. The configuration of the southern hemisphere makes it impossible to derive an independent figure of the Earth in that hemisphere, but if the radius vector is derived from the northern hemisphere the measurement of meridian arcs will give a determination of the flattening in the southern hemisphere.

The following paragraphs 1 to 10 are, with slight abbreviation,



III. The Western European Arc compared with Bessel's Figure

(a) from the Deflections calculated by Schumann

(b) from the Deflections corrected for Isostasy by Heiskanen

the same as in the communication made to the Section of Geodesy at Madrid.

1. In Fig. I. I have plotted the differences in the lengths of meridian arcs for several of the principal figures, compared with Clarke 1880. Thus, for example, the arc from the equator to latitude 50° is about 95 metres greater for Clarke's figure of 1866, and 212 less for Everest's figure. One sees at once that although Everest's figure (a 6377276 m.; f 1/300.802) is very different from Clarke 1880 (a 6378245) m.; f 1/293.465), yet over the range of latitude (8° to 30°) for which Everest's figure has been used, the meridian arcs are very little different from those of Clarke, and a very small transformation will be required to refer

meridian deflections from one figure to the other. Similarly, over the range of latitude (25° to 50°) for which Clarke's figure of 1866 has been used in the United States, the differences from Clarke 1880 are very nearly constant.

2. Now suppose that we have a set of meridian deflections $G - A$ referred to Bessel's figure. Let the deflections in seconds of arc, as ordinarily given, be turned into metres, and plotted against the curve for Bessel in Fig. I. We can see at once, by inspection, how they will fit any other of the figures whose curves are plotted. We draw a median line or curve as best we may through the plotted points and judge of the fit to other figures by the approximation to parallelism with their curves. For example, in Fig. III. we have plotted the meridian deflections deduced by Schumann* for the Franco-British arc against the curve for Bessel's figure, on which they were reduced. We see at once that they do not fit Bessel: but that a median line drawn through them is practically horizontal: that is, they do approximate much more closely to Clarke 1880.

3. It is easy to interpret the slope or curvature of such a median line by consideration of Fig. II., which shows the effect on the length of any meridian arc from change in adopted semi-axis major a or in the reciprocal of the flattening r ($= 1/f$). In Fig. II. we have plotted the effect of increasing a by one, two, and three parts in one hundred thousand; and of increasing r by one and by two per cent. The former we will call "radius curves"; the latter "flattening curves." These variations cover the range of the modern figures, as is shown by this table:

a	...	...	6378249	r	...	...	293'465
1'00001 a	...	...	6378313	1'01 r	..	...	296'399
1'00002 a	...	...	6378376	1'02 r	...	...	299'334
1'00003 a	...	...	6378440				

The "radius curves" are on the scale of any diagram indistinguishable from straight lines; the "flattening curves" are very nearly straight between latitudes 0° and 30° ; they rise to a maximum about latitude 54° ; the chords from 40° to 70° or from 45° to 65° are horizontal.

4. Now any median line or curve drawn among a series of points representing meridian deviations from any assumed figure should approximate to a curve compounded of a radius curve and a flattening curve: and our object is to disentangle the two components. We see at once:

- (a) That in tropical and sub-tropical latitudes the compound curve is so nearly straight that the components cannot be distinguished. Hence a meridian arc in these latitudes can by itself make no discrimination between radius and flattening.
- (b) That an arc in middle latitudes, between 30° and 50° may begin

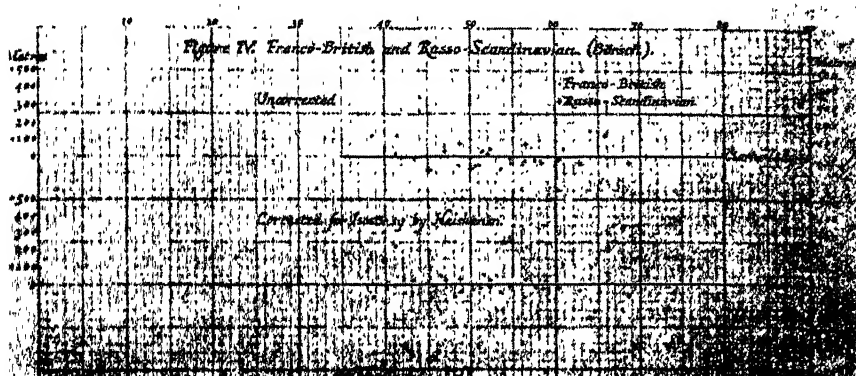
* C. R. Int. Geod. Assoc., Budapest, 1906, I. 244.

to show a curvature due to the flattening component, but this curvature is so small that no good separation is possible.

- (c) That the most useful single arc is in high temperate latitudes between 40° and 70° . If the median line or curve is drawn through a series of plotted points, the difference of ordinates at the two ends gives immediately a correction to the semi-axis, independent of the flattening; while the curvature of the median curve gives a rough indication of the correction to the flattening.

With these guiding principles we may proceed to discuss the principal geodetic material.

5. Consider first the arcs in higher latitudes covering the critical portion of the curve. We have already seen that Schumann's reduction of the Franco-British arc gives a median line practically horizontal (Fig. III.). The combination of the Franco-British and Russo-Scandi-



IV. Combined Franco-British and Russo-Scandinavian Arcs compared with Clarke's Figure of 1880

(a) from the Deflections calculated by Börsch

(b) from the Deflections corrected for Isostasy by Heiskanen

navian arcs by Börsch* (Fig. IV.) gives much the same. If the median curve is not a straight line its convexity is downwards. By 4 (c) we conclude that these arcs indicate no increase in a , and if anything a decrease in r .

6. Take now the great Indian Arc of Meridian. The median curve slopes up steeply to about latitude 22° , then down steeply to about 25° , and then up very steeply to latitude 30° . The last is doubtless due to the abnormal attraction of the Himalaya and the plateau of Tibet. The intermediate slope downwards is usually attributed to the "Gangetic trough." The first slope upwards from latitude 8° to 22° might be taken to require a considerable increase in a , or in r , or in both.

7. The South African arcs, due to the initiative of the late Sir David

* Int. Geod. Assoc., Paris, 1889. Annexe A. II.

Gill, have been discussed in a preliminary way by Bahn ('Beiträge zur Geophysik,' vol. 10). The figures he gives are not quite the same as those in the original reports. I have used the latter, and have included a number of stations not used by Bahn. The result has a curious analogy to the Indian results. The median line slopes up strongly to about latitude 22° and then strongly down again, thus repeating in the southern hemisphere the phenomenon of the "Gangetic trough." It would seem, therefore, that this effect may be more than a local phenomenon of India. The abnormality common to the two makes it impossible at present to deduce from either any corrections to α or to τ .

8. We will next extract from the voluminous material discussed by Hayford ('The Figure of the Earth and Isostasy') the meridian deflections along the Arc of the 98th Meridian, and the Eastern Oblique Arc with its extension into Florida. Fig. VII. shows the results plotted against the curve of Clarke 1866, from which they were derived. I have taken first the deflections uncorrected for Isostasy. It is not easy to draw median lines curves among so many plotted points, but I think it will appear that the curves have convexity upwards: and that this convexity is greater than that belonging to the Hayford figure of 1910, as plotted above them. This might be interpreted as requiring a rather large increase in τ combined with a very large decrease in α . But I do not suggest that as the true interpretation.

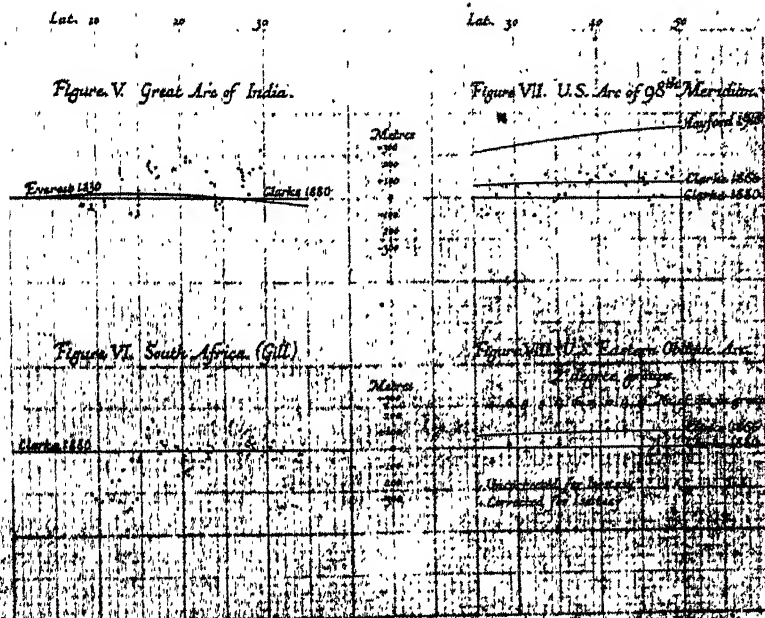
9. I then plotted the 98th meridian deflections corrected for isostasy complete at 120'9 km. The slope of the median curve seems to be at first in good agreement with Hayford's figure, but there is a marked downward turn in the higher latitudes which gives an effect of excessive curvature, as noted above in § 8 for the uncorrected results. (Fig. not reproduced here; but see *Travaux*, Madrid.)

In Fig. VIII., to avoid the scatter, I have combined the individual results of the Eastern Oblique Arc into means for each 2° of latitude, and plotted both uncorrected and corrected. There is a marked difference between the two: but it should be noted that the results corrected for isostasy give on the whole a smaller slope and confirm the turning down in high latitudes.

In general, one may say that these two U.S. arcs are not markedly discordant from the Hayford figure of 1910 to which they contributed: but that the rather abrupt turn downwards above latitude 40° is disquieting, especially since it is seen quite clearly in both the arcs.

10. I had hoped that the results of the remeasurement of the Arc de Pérou (courteously communicated by Colonel Bellot) and of the Russian section of the Spitsbergen arc (the Swedish section is still unavailable) would have made an important contribution to this discussion. Unhappily it was immediately evident that these isolated arcs are too short or the irregular deviations of the vertical are too large, to allow any deductions from them.

Since the Madrid meeting the results for the Franco-British and Russo-Scandinavian arcs have been corrected for isostatic compensation by Dr. Heiskanen (*Die Erddimensionen nach den Europäischen Gradmessungen*, Veroff. Finn. Geod. Inst. No. 6, Helsinki, 1926), and are plotted in Figs. III. and IV.* It is at once apparent that the correction has somewhat improved the fit, without changing the first conclusion, that these arcs fit Clarke 1880 as well as they fit any other figure. If the Madrid radius is right the median curve should stand 74 metres higher at 70° than at 40° ; and if the Madrid flattening is right the median curve at 55° should be 24 metres above the chord 40° to 70° . The



- V. The Great Arc of India calculated on Everest's figure
 VI. The Arc of South Africa (30th Meridian) on Clarke 1880
 VII. The U.S. Arc of the 98th Meridian on Clarke 1866
 VIII. The U.S. Eastern Oblique Arc, with correction for Isostasy

results are so scattered that we can derive no certain result. If there is any convexity in median curves, it would seem to be downward rather than upward. If we disregard the very discordant results in Schumann's lower latitudes, and imagine that the rest give a decided general slope upwards, we find little confirmation in the Börsch results; and cannot

* A few of the Franco-British results used by Börsch but not by Schumann have not been calculated by Heiskanen: hence a few points are missing from the isostatic plot.

but feel that one or two more observations might alter the whole effect.

It is therefore clear that the number of astronomical latitudes is quite insufficient to give a satisfactory solution, especially in the Russo-Scandinavian arc, which has only thirteen in all. It is said that Struve did not mark his stations with sufficient care, and that most of the Scandinavian stations are lost, while many of those farther south were destroyed during the war. One would hope, however, that they could mostly be recovered within a few metres, while the discordances between the geodetic and the astronomical latitudes are equivalent to a hundred or two. The stations of the Franco-British arc are mostly well marked. It appears to me that the most useful geodetic enterprise in Europe at the moment would be to observe astronomical latitudes at or round about all the stations of these two arcs. Following the method adopted in India for the initial latitude of Kalianpur, one would probably observe at a group of sub-stations round about each principal station, connected to it trigonometrically, and usually in positions much more convenient for observation. No very great accuracy would be required, since the residual local attractions are so considerable. What is wanted is a great number of observations at as many stations as possible.

These are the arguments in support of my propositions D and F, which are indeed self-evident from the diagrams. The great Struve was content with observing thirteen latitudes between Hammerfest and the mouth of the Danube. The British and French did better than that, having thirty-one latitudes between Shetland and Barcelona. But it seems to me that if the problems suggested by this graphical reduction are to be solved, we must undertake astronomical observations on quite another scale, and consider it the normal procedure to observe a latitude at every first and second order station at least, if not in groups of sub-stations. This would be necessary if it were merely a question of deciding with certainty between the contending figures now in use, based on the assumption that the geoid differs only locally from an ellipsoid of revolution. It is doubly necessary if the ellipsoid may have three unequal axes. But it is many times necessary if one must admit the possibility that there are in the Earth deep-seated irregularities which make the ellipsoid only a poor approximation to the truth; and that is what some of the above results, especially the South African arc of meridian, most strongly suggest.

The graphical discussion of Gravity Surveys.

It is natural to examine whether this possibly fruitful and very simple way of looking at the problem can be extended to the discussion of gravity surveys. Happily there is in the memoir of Dr. Heiskanen (*Untersuchungen über Schwerkraft und Isostasie*, Veröffentlichungen des Finnischen Geodätischen Institutes No. 4, Helsinki, 1924) a rich store of material ready to hand.

Dr. Heiskanen refers his calculations to the expression used by Borass, which is conveniently designated Helmert I.

$$\gamma_0 = 978.030(1 + 0.005302 \sin^2 \phi - 0.000007 \sin^2 2\phi)$$

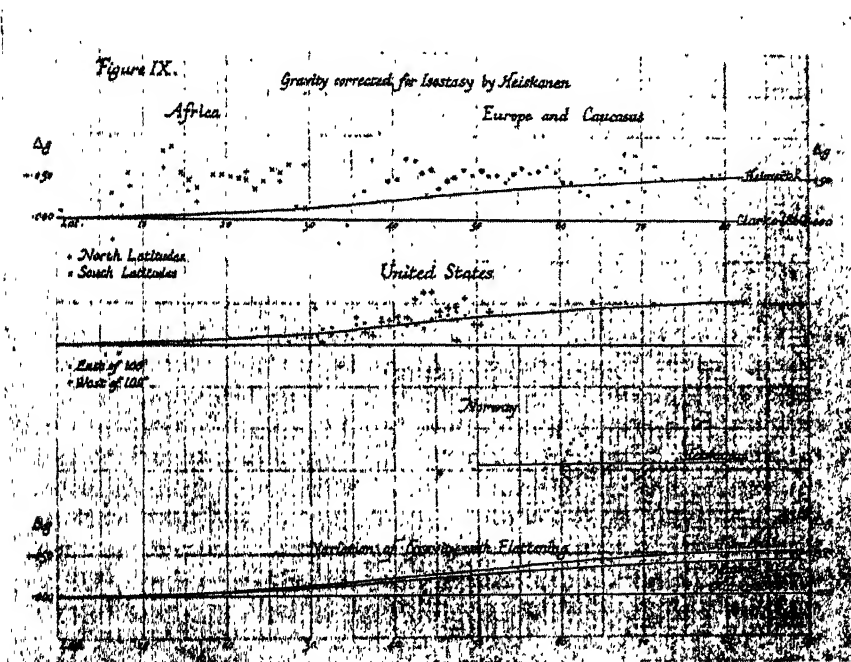
A change in the flattening affects the coefficient of $\sin^2 \phi$. Thus the corresponding coefficients for the flattening of Clarke 1880 and of Hayford 1910 (Madrid 1924) are 0.005248 and 0.005289. If then as before we take Clarke 1880 as the base of ordinates, and plot the differences of Madrid and Helmert I from the curves

$$\gamma = 978(0.000041) \sin^2 \phi$$

and

$$\gamma = 978(0.000054) \sin^2 \phi$$

we have the following results (Fig. IX.):



IX. Graphical Examination of Gravity Observations

We see at once that the difference between Clarke 1880 and Madrid 1924 is equivalent to a variation of 0.020 in the value of gravity between the latitudes 40° and 70° : a difference which should be plainly visible in the gravity determinations of Europe alone.

Let us now plot the gravity anomalies (referred to Helmert I) given in column 2 of Heiskanen's table XIII., pp. 82 *et seq.* for stations in Europe and the Caucasus, corrected for Hayfordian isostasy with depth of compensation 113.7 km. His figures are given as means for each degree square. I have further combined them into means for all the degree

squares for a degree of latitude, and have indicated roughly by the size of the dots the number of squares thus combined. I have extended the diagram into lower latitudes by adding the stations on the coast of Africa, showing them by crosses instead of dots.

One would say at once that the best curve drawn through this assemblage of points is not far from a horizontal straight line: that is to say, the flattening deduced from these results cannot be far from that of Clarke 1880. In fact, Heiskanen from his solution by least squares deduces from Europe and the Caucasus (the dots) a flattening 293.8, or if Africa is taken in, 294.5. On the other hand, from stations in Asia alone he gets 299.8, and from the United States alone 299.2, while from a combined solution for all he derives 297.4, or very nearly the figure of Madrid 1924. He concludes however that these differences are too large to be explained otherwise than by a longitude term, implying that the equator is elliptical, and deduces finally the following expression for gravity:

$$\gamma_0 = 978.052[1 + 0.005285 \sin^2 \phi - 0.000007 \sin^2 2\phi \\ + 0.000027 \cos^2 \phi \cos 2(\lambda - 18^\circ)]$$

If in this we put $\lambda = 18^\circ$, which is about the mean longitude of the European stations, the expression reduces to

$$\gamma_0 = 978.052[1.000027 + 0.005258 \sin^2 \phi - 0.000007 \sin^2 2\phi]$$

which agrees very nearly with that derived from Europe and the Caucasus.

Let us now plot the American results and see how they have contributed to this longitude term. If this longitude² term is right, the stations in the Eastern United States should give a larger value for the reciprocal of the flattening than the western.* In the following diagram the means for stations east of 100° W. are indicated by dots, and those to the west by crosses. We see at once that on the contrary the latter give a greater slope to the curve than the former, and must conclude that at first sight a simple longitude term of the form adopted does not appear to be satisfactory. And we may remark in passing that the coefficients of the longitude term derived by Helmert, $\cos 2(\lambda + 17^\circ)$ would not fit the American results much better.

In his discussion of 1924 Heiskanen omitted the gravity determinations in Norway, because he was not able at that time to reduce them for isostasy. In a more recent paper: *Schwerkraft und Isostatische Kompensation in Norwegen*, Helsinki, 1926, he has calculated the gravity anomalies for forty-six stations, referred to his own formula for gravity. Neglecting the longitude term, and plotting them with respect to the curve expressing the deviation from the flattening of Clarke 1880, as before, the result in Fig. IX. shows clearly that the Norwegian results tend quite strongly to thrust the curve downwards in high latitudes, or

* Between longitudes 70° and 100° W. the average coefficient of $\sin^2 \phi$ is about 0.005308; between 100° and 130° W. it is 0.005287, by Heiskanen's formula.

to bring the reciprocal of the flattening below Clarke's value, instead of above it.

It seems to me, therefore, that this preliminary reconnaissance of the gravity results shows that at any rate for Europe Clarke's flattening is very near to the truth, and that the Conference of Madrid was unfortunate in imposing upon Europe a figure of the Earth which may fit the United States tolerably well, though not without suspicious signs of abnormality, but which does not clearly fit Europe at all well, whether one judges by deviations of the vertical or by anomalies of gravity.

Before we can say with confidence what figure—if any—is most fit to be adopted for the world in general, we must investigate more fully those abnormalities which have come to light in the present graphical discussion, and others which will doubtless appear when accurate geodetic work is extended beyond its present rather restricted limits. At each stage I would suggest that the observations may with advantage be discussed graphically, in order to see what sort of contribution they are going to make to the general problem. If they do no more than to postpone indefinitely that task of a lifetime to which Mr. McCaw referred, these graphical methods will perhaps have justified their existence.

The new Geodetic Tables which will be published by this Society in the course of a few weeks were originally suggested by the idea of the graphical discussions, but of course go far beyond its possible requirements. They have in fact been computed to a degree of numerical accuracy beyond what can ever be justified by our real knowledge of the dimensions of the Earth. We shall never know to a millimetre the distance from the equator to Fuglenaes. But bitter experience during the war showed how necessary it is for the computer of large-scale grids to have at his disposal, as a foundation, tables which are self-consistent to an almost unnatural degree; and much the same need arises in peaceful cadastral survey. We have therefore taken much trouble to get these tables correct to the last figure printed. As a final check after the tables were put into type Dr. Comrie, of H.M. Nautical Almanac Office, very kindly undertook to build them up entirely anew from the second differences on the electrically operated calculating machines which are now in use in that office. He found only two mistakes of any consequence, but was able to smooth last figures so successfully that fourth differences of 6 are very rare, and there are none greater. One of these machines printed automatically an independent copy of the tables, which will be used for a final reading after the tables have been stereotyped. He is not willing to say more than that "it is believed that all the quantities printed are correct to a unit of the last decimal," but admits that the limiting error of a unit is probably rarely attained. For all practical purposes we have confidence, therefore, that the tables are numerically perfect, and for that have to thank in the first instance Dr. Jackson and his com-

puters at the Royal Observatory, and finally Dr. Comrie and his machine operators at the Nautical Almanac Office.

As a final check on the accuracy of the expressions used in the calculation I have compared the columns for Madrid 1924 between latitudes 59° and 71° with Väisälä's tables. His third place of decimals of a metre in the Meridian Arcs either agrees with mine or is one unit greater; his values for log M and log N to eight places agree exactly (except for one slight misprint of his) with my nine-figure tables reduced to eight. This is a complete and satisfactory verification both of the expressions from which the tables for Clarke 1880 were calculated, and of the method and results of the transformation.

Before the paper the CHAIRMAN (Col. Sir CHARLES CLOSE) said: We are going to listen this afternoon to an important paper by Mr. Hinks on "A Graphical Discussion of the Figure of the Earth," a paper of which some of you may have seen a proof; a really valuable paper containing many new ideas. I will call upon Mr. Hinks to read it.

Mr. Hinks then read the paper printed above, and a discussion followed.

Col. Sir GERALD LENOX-CONYNTHAM: I would like to say a word or two with reference to Mr. Hinks' evident dissatisfaction with his colleagues at Madrid. I was one of them, and I think I may be allowed to give a little explanation.

It had been decided pretty definitely by the Congress that it was desirable to come to some decision at that meeting; to adopt some figure, not to leave the matter over for another three years. Also at these international meetings one knows that what is said at a session when all are present is not, as a rule, very fully understood—there are too many people speaking different languages—so that one must ascertain the feeling of different members of the Union by conversations between the meetings. The British delegation, I think, had arrived pretty clearly at the idea that there was no hope of getting the Clarke figure of 1880 accepted; that we had to concentrate upon some policy other than that—on some decision which was not for Clarke 1880. For the flattening the figure of 1/297.0 had strong support from the fact that it had been adopted, I think I am right in saying, by the Nautical Almanac and by the Astronomical Union on grounds other than geodetic.

Then, as Mr. Hinks has mentioned, we attempted to get carried a value for the radius of the Equator which was a round figure. This was intended to indicate that we did not think there was any sense, on the evidence before us, in expressing that radius down to a single metre. However, the vote went against us. But I would not be inclined to think that any great harm has been done. What was wanted was not an expression of opinion as to what was the actual figure of the Earth, but to get the different countries to adopt one figure as a figure of reference so that all anomalies should be, as far as is possible, in the same terms, and thus we should not have the different curves that Mr. Hinks has shown us, but should have everything expressed in terms of one spheroid. I think the task before geodesists of deriving results from the observations in different countries will be considerably simplified if the different countries will express all their geodetic anomalies in terms of one spheroid of reference. It does not matter very much whether that spheroid of reference

is a very close approximation to the truth or not; it is the adoption of one spheroid for general use that is important.

But let us suppose for a moment that we did at Madrid make a serious blunder, that we have adopted a figure which is not very near the truth and which we shall have to give up in the future. That would have seemed rather serious three years ago at Madrid, but now, with Mr. Hinks' tables, it does not seem to involve any trouble at all. He has provided us with such a beautiful tool that I believe the transformation of geodetic data from one spheroid to another has become a simple and easy thing which can be done quite mechanically by anybody with those tables in his hand. So that the first point I would like to make with regard to the tables is that they provide a most convenient tool and one which, I think, can be very easily and safely used. There is always a danger in using a new tool that you may cut your fingers, but I do not see at present that there are likely to be pitfalls in the use of these tables.

I was much struck by two things in what Mr. Hinks has said. The graphical method that he has shown us seems to me to be most useful in indicating the direction in which it would be well to turn geodetic effort. He showed, for instance, from his diagrams that the observation of certain latitudes would be useful. That sort of question is rather difficult to deal with by ordinary methods, and I think this graphical method will be extremely useful in that respect.

Lastly, almost at the end of his paper Mr. Hinks used these words: "Before we can say with confidence what figure—if any—is most fit to be adopted for the world in general . . ." I take it that by that "if any" Mr. Hinks means that we may find that the flattening is pretty different in different longitudes, and that it may not be convenient for different countries to reduce all their surveys to the same spheroid; that possibly it would be well for each country to determine its own flattening and its own figure and to reduce its surveys to that figure. That is a very interesting consideration. If we find that the geoid does not approximate closely to any ellipsoid whatever, that will indicate that each country should adopt its own figure and refer its surveys to that figure. This is perhaps a refinement which is not very necessary from a practical point of view, but it is an interesting consideration and one which is new to me.

Col. H. S. L. WINTERBOTHAM: I was also struck, like Sir Gerald, with Mr. Hinks' words in the expression "if any," because quite apart from the scientific aspect of the case we have to consider what capital is locked up in the various figures in use in different parts of the world. It is certainly safe to say that the geodesy of the British Empire at the present moment is constructive rather than analytical. We cannot expect geodesists who are at present at work in Africa—I wish one could say they were at work in all parts of the Empire—to put their results in terms of a special figure for the convenience and education of the assembled geodesists at Prague. They have not the time, nor will they be able for many many years to put their results in terms of that figure which may prove to be the best for that continent. On the other hand, they might reach a practical solution in getting the whole continent on one figure, though that figure may differ from the one which we have adopted for the world at large. Africa as a continent is, as a matter of fact, almost entirely on the Clarke figure of 1880. You may go from Cape Town to Mount Ruwenzori upon Clarke's figure of 1880. You may go all through Northern Africa also on that figure; and the Belgians have agreed to use it in the Congo. We are doing a great deal of work at present in connection with Boundary Commissions in conjunction with the Belgians, and we shall hope soon to have

interesting data upon which, we trust, Mr. Hinks may experiment to see whether that Northern Rhodesia anomaly really exists. On the other hand practical uniformity in Asia is not, it would seem, possible. In that connection I would like to know what the effect of the longitudinal extension of the Everest figure may be, because it is, I think, greater than its range in latitude. The Everest figure extends, for example, to Mosul on the west and to Singapore on the east.

I was another of Mr. Hinks' colleagues at Madrid. His proposal, unfortunately, had a political aspect as well as a scientific. The Clarke 1880 figure is one which is widely used by the Allies and not at all by the Central Powers. It seemed, then, rather unwise and untimely to press for its universal adoption.

Finally, I should like to express my personal thanks to Mr. Hinks for his paper. From a profound study of intricate mathematics we have all of us, I expect, arisen exhausted, unconvinced, and possibly uncomprehending. From a simple graph we may not get, perhaps, that precision which must finally be obtained, but we do get those broad and evident conclusions which enable us to understand the work of more profound mathematicians than ourselves.

Mr. G. T. McCaw: I should like to say that this is one of the most interesting papers from my point of view that I have read for a long time. I should like to help in throwing some light on Mr. Hinks' main propositions. The analytical method is more or less independent of the graphical, and it will be found to lend support to many of his conclusions. If a certain spheroid is taken as reference, the difference between the astronomical and geodetic measure (A—G) of a component part of a meridional arc gives an equation wherein the (A—G) above is expressed in terms of a change of the semi-axis major and a change in the eccentricity of the meridional ellipse. Robbed of its trappings, the equation becomes—

$$\Delta\phi\frac{\delta a}{a} - \frac{1}{2}\Delta\phi(1 + 3 \cos 2\phi_m)\delta e^2 + \Delta\phi - \frac{m}{\rho_m \text{ arc } 1''} + v = 0$$

where a is the semi-axis major and e the eccentricity;

ϕ , in seconds, is the difference of the latitudes of the extremities of the component part of the arc;

ϕ_m is the mid-latitude of the component reach, here considered short;

m is the geodetic measure of the component;

ρ_m the radius of curvature at the mid-latitude;

v is the residual of an observation equation.

The most important point, noticeable at once in the equation, is the independence of the coefficient of $\delta a/a$. The coefficient is simply $\Delta\phi$, the astronomical length of the component. The coefficient of δe^2 , on the contrary, involves the latitude ϕ_m . This coefficient, $\frac{1}{2}(1 + 3 \cos 2\phi_m)$, has the following values at different latitudes:

Lat.	0°	..	..	coeff. +1	Lat.	45°	..	..	coeff. + $\frac{1}{2}$
"	15°	..	..	" +$\frac{1}{10}$	"	54° 44'	..	..	" 0
"	10°	..	..	" +$\frac{1}{8}$	"	60°	..	..	" -$\frac{1}{8}$
					"	90°	..	..	" -$\frac{1}{2}$

Now if we consider component parts of an arc in the tropics, we see that the coefficient of δe^2 is very much the same as that of $\delta a/a$. If, then, there are two equations of the form above, in which the coefficients of the unknowns $\delta a/a$ and δe^2 are nearly the same throughout both equations, it is immediately

obvious that the unknowns cannot be evaluated with any precision. The same result appears in the normals formed from a number of equations: the solution becomes unstable. This confirms Mr. Hinks' conclusion that it is not possible to disentangle the correction to the semi-axis major from the correction to the square of the eccentricity, when the component arcs are in the tropical zone.

Again, consider latitude 45° . Here the coefficient of δe^2 has fallen to $\frac{1}{4}$; the weights of the determinations of the semi-axis and the eccentricity may then be taken as 16 : 1. In other words, the eccentricity cannot be well determined from meridional arcs in mid-latitudes. (It may be added that the addition of arcs of parallel makes matters no better.) In higher latitudes a critical point is reached at $54^\circ 44'$, where the radius of meridional curvature is equal to the mean of all such radii, that is, equal to the semi-axis major itself. Here the coefficient of δe^2 is zero, and, as Mr. Hinks points out, the semi-axis major is obtainable directly from the measures. At latitude 55° , then, the curvature cannot be determined from meridional arcs.

Hitherto I have considered arcs confined to single zones. The conditions are utterly different when arcs in different zones are *combined*. Thus, a combination of arcs in high and low latitudes will give the best determination of the curvature; in fact, the difference between the coefficients of δe^2 is a maximum, namely, $3\Delta\phi/2$ for equal lengths, when one arc is at the Equator and another at the Pole. I have no doubt that the graphical method will be extended by Mr. Hinks to combinations of arcs in different latitudes and to the inclusion of arcs of parallel.

Time forbids further reference to consequences which might be considered; but I should like to add a tribute to the interesting application of the graphical method to gravimetric surveys. If I may express an opinion, I think that this adds greatly to the value of the paper and demands our admiration.

Mr. H. L. P. JOLLY (Ordnance Survey): Mr. Hinks' elegant method of examining the bearing of the various meridian arcs on the determination of the Figure of the Earth is an example of the great power which is possessed by graphical methods, which convey at a glance certain results which would only be obtained otherwise by a very lengthy study and perhaps not at all. It constitutes also admonition. I will confine myself to that portion of it which is supposed to represent the best geodetic work which has been done, namely, the observations in the United States. Those have a mean date very much later than the bulk of the others. The latitude determinations are very numerous. What, then, do we see on the diagrams representing the United States? Even if we consider the isostatically reduced ones—a procedure to which we may possibly have some objection—what do we find? You will remember Mr. Hinks explained that the determination of the a of the ellipse depends on the general slope of the curve in the diagram, whereas the determination $(a-b)/a$, or flattening, depends upon whether the best line drawn through points is straight or curved and, if so, how much. I think you will find in the diagram representing the United States that the points range up and down by three or four times the sagitta of the supposed curve representing them. The state of affairs as regards the determination in that area of the Earth is that you can determine a combined factor, as it were. If a is so much, then the flattening is so much. You can say it with some certainty. And also if the flattening is so much, then a is so much. I think Mr. Hinks has done service in drawing attention to this fact, not only in regard to the United States determinations but about all previous work.

I do not think these facts were quite noted as they might have been at

Madrid. What did give a great deal of strength to the figure of the Earth which was adopted in Madrid was Helmert's dictum that the best method of determining the flattening was an examination of gravity observations; and, secondly, that Helmert's solution was identical with Hayford's. I am surprised to hear Mr. Hinks say that examination of Heiskanen's observations, of all the gravity determinations to date, shows more agreement with Clarke's figure of 1880 than Helmert's, because I was under the impression that the majority of points were at the disposal of Helmert and *ipso facto* that his flattening, which is identical with Hayford's, would represent the points.

Dr. L. J. COMRIE (H.M. Nautical Almanac Office): I am not a geodesist but rather an intruder here to-day, though I came on Mr. Hinks' invitation because I hoped to see an illustration of a method of attacking a problem, and that is wherein my interest in this particular problem lies. Too often people do not apply common sense to their computations. I congratulate Mr. Hinks on having done so, in spite of his handicap, for I believe he is a trained mathematician. One very frequently sees a trained mathematician taking some figures, deducing a result, perhaps laboriously by the method of least squares, giving the result and a probable error, the latter being several hundred times, and in many cases thousand of times, the unit adopted. The graphical method gives all that the eye can take in. Figures do very little more. If we see a row of eight figures we take in about two, form some mental conception of the two, and ignore the rest. This graphical method, I think, has shown us all that figures could show, and more. Certainly it has pointed out the path for future work.

One point in regard to the table occurs to me, namely, that instead of giving the variation for one per cent. in r it might have been better to have tabulated the variation for one per cent. in n , since the variation is proportional to n and not to r . However, by a little adaptation the tables can be used conveniently.

Mr. HINKS: It is so late that I will attempt to reply only very briefly. Considerable comment has been caused by those two words "if any" in my paper. What I meant by "if any" is not to go quite so far as Sir Gerald Lenox-Conyngham suggests, to wish each country to have a different figure, but I think I would go as far as to suggest that possibly each continent may want a different figure at least for the next century.

Then I have been asked why I have not dealt with longitude arcs. I think I have sufficient excuse in that the one or two longitude arcs which exist—at any rate the most conspicuous, the middle European, has notoriously got something peculiarly wrong with it at one end. I think that until all the longitudes have been determined by wireless it is probably too early to discuss longitude arcs, but I fully agree that it must be done.

Mr. Jolly has asked how it is that Helmert's flattening agrees so precisely with that of Hayford in spite of Heiskanen's results. I cannot answer that fully from memory, but I would point out, at any rate, that Heiskanen has shown that from gravity at stations more or less in the longitude of Europe the reciprocal of the flattening is 1 : 293 or 294, whereas in the United States the results obtained by Bowie give 299 or 300, or even more. There is a vast difference between the results for the United States and for the European longitudes, and of course the result of that is when you put them together and get a general discussion you get about 297, which is sufficiently obvious. But if you look at Bowie's results for the United States you find he does not want a flattening of 297; he wants 299 or 300 at least.

I fully agree with Dr. Comrie that it would have been much better to have

that table calculated for the variation of one per cent. in n instead of r , and if one had known at the beginning what one knows now one would have done so. It was, as a matter of fact, quite a happy discovery that the variation was so very strictly proportional to n that one can actually make transformations with an accuracy of one in the 9th figure or so. I believe Mr. McCaw was as surprised as I was when it came out. It shows only how it is possible to make a happy discovery by pure accident. It did not seem worth while having the whole thing recomputed again, because it was so easy by adjustment to make use of the r variation instead of n . I am sorry now, considering the enormous efficiency of Dr. Comrie's machines and the help they have been able to give, that we did not, as a matter of fact, scrap the r table and recompute the whole thing.

The CHAIRMAN: It only remains for me, in the name of the Society, to thank Mr. Hinks for an extremely instructive lecture. He has endowed Geodesy with a new apparatus which is sure to be increasingly used as time goes on. I was struck with the suggestion made during the discussion that we might have a figure for each continent, and perhaps British delegates at Prague will see that Africa is not forgotten. It might be worth considering whether some figure could be adopted for Africa from a purely practical point of view. I think we all agreed with Dr. Comrie when he spoke of the value of common sense in all these discussions, and we have had to-day an example of a mixture of mathematics and common sense which it would be hard to beat. I beg to thank Mr. Hinks.

METEOROLOGY IN HISTORY

Manual of Meteorology. Vol. I. *Meteorology in History.*— Sir Napier Shaw, LL.D., F.R.S., with the assistance of Elaine Austin. Cambridge: University Press. 1926. $10\frac{1}{2} \times 7\frac{1}{2}$, pp. xx. + 340. *Plates and Illustration.* 30s. net.

THE choice of matter to include in or to omit from this volume, which is the first of four, must obviously depend as much on the scope and purpose of the whole great 'Manual of Meteorology' as on the subject specially marked out for treatment as *Meteorology in History*, and vol. I cannot be criticized as if it were a work complete in itself. The author is to be congratulated on his courage in tackling a tremendous task, the completed outcome of which cannot fail to be a monumental treatise. In the first volume he deals mainly with meteorological theory through the ages, viewing meteorology in history as a forward movement in which the present state of the science is linked backwards with the speculations of Aristotle and the early observations of Dampier, and forwards with the functions of an ideal International College of Meteorology whose cloud-capped towers glimmer somewhere in the future. Such comprehensiveness of view affords ample scope for the method of exposition by relevant digression by which Sir Napier Shaw succeeds in imparting to his students something of his own circumambient mind.

The first inspiring chapter on Meteorology in European Culture is followed by one on the Climate and Weather of the Mediterranean Region as known to-day and another on the measurement of time and the calendar. Chapter iv. returns to the early poets and historians, including references to weather in the Hebrew scriptures, Homer, and Herodotus. Next comes a discussion of

Aristotle's 'Meteorologica' and Theophrastes' 'On the Winds,' supported by long and apt quotations from standard translations and illustrated by reproductions of the eight figures from the tower of the winds at Athens. Chapter vi. is a study of the Variability of Mediterranean Climates in historical times according to the latest scientific views. Chapter viii. drops back to Weather-lore, Astrology and Almanacs from the time of Aristotle to the invention of the barometer, but darts forward at the end to the "new astrology" which takes account of solar radiation and sunspots in our own day. The next chapter, on the Reign of the Barometer as Weather-glass, is the longest in the book. In it the student in search of a consecutive narrative must, no doubt greatly to his benefit, scratch like a fowl in a farmyard, as the bulk of the information is supplied in the form of short biographies of seventy-four men of science, the earliest born in 1561, the latest in 1818, whose work was of vital importance in the development of meteorology. Here, as elsewhere, all foreign quotations are translated into English except some of those in French, which are often lengthy and appear as written. The arrangement of the biographies is chronological according to the date of birth, and the fine index with which the volume is provided proves its value in looking up names of those whose birthdays have slipped the memory. Space is of course tyrannical, but one feels that in a few cases some more facts might have been fitted in and some of Sir Napier Shaw's opinions as to the work of his predecessors allowed to find expression. Still this *Who was Who in Meteorology* brings together much which it would otherwise be difficult to find, and makes us wish that an extension of it could have been given in the next chapter to carry the record through Victorian times.

These eight chapters bring meteorology down to the era of the synoptic chart and fill half the book. Perhaps more might have been made of the thermometer, including the battle of the scales, and of the development of the rain-gauge and the long fight for uniformity in conditions of observing; but after all that would be more appropriate in a history of practical meteorology than in the introduction to a work dealing mainly with theory. Such a plea would have less force in justifying the surprising omission of direct reference to the immense services rendered by Meteorological Societies and other voluntary associations in the days when meteorology was ignored by the universities and research was not promoted as it is now by government departments.

The second half of the book deals in very satisfactory detail with the rise of international meteorology and the development of the science in the observatory for the surface and the upper air, in the laboratory for the physics of the air, with chapters on arithmetical and graphical methods, on the analysis of air-movement into the general circulation and the cyclone, and a final summary of meteorological theory in history full of fresh light on old problems and with some surprising flashes like that which finds a forerunner of the theory of the polar front in Aristotle.

Sir Napier Shaw takes the world as his meteorological parish and his treatment is essentially geographical, though the use of meteorological maps is but briefly treated. Some geographers may possibly dislike his method of representing the Earth's surface by a composite map on three different projections in five portions, each touching its neighbour at one point only and none of them giving straight rhumb lines or equivalent areas; but the strange scheme has certain advantages.

A reader fresh to the subject might possibly fancy that this work was produced in an atmosphere more official than academic, but he would be dull indeed if he did not recognize through its formal phrases the play of wide human sympathies and the stamp of the strong personality of the author which has impressed itself not only on his writings and on the meteorological service of his country but on the fundamental principles of Meteorology itself.

HUGH ROBERT MILL.

REVIEWS

EUROPE

The Settlements and Roads of Scotland.— Grace Meiklejohn, M.A. Edinburgh: Oliver & Boyd. 1927. 9 × 6, pp. xvi. + 144. 2 Coloured Maps, Sketch-maps, and Illustrations. 12s. 6d. net.

AS we learn from Dr. Chisholm's Foreword, and as is also abundantly clear from the contents, this study of the human geography of Scotland is based upon long-continued field-work, as well as upon wide reading of the relevant literature. The distribution of the population, the nature of the settlements, the occupations of the inhabitants, and the lines of communication are studied in four chapters dealing respectively with the Northern Highlands, the Midland Valley, the Central Highlands, and the Southern Uplands. The islands are omitted, the investigation having been confined to the mainland. The fact that of the 134 pages of the book only 32 are devoted to the Midland Valley, in which the bulk of the population of Scotland is settled, bears out the point made in the Foreword that the emphasis is laid throughout upon the diversity of relations which exist outside the coalfield areas, rather than upon the phenomena of industrialization, which present generally similar features wherever they occur. The two beautiful coloured maps, on the scale of 10 miles to the inch, which accompany the book, the one orographical and the other geological, help to make clear the diversity of relief and the associated complexity of geological structure which have influenced so profoundly the human geography of the country. In addition to the coloured maps a number of sketch-maps, mainly town plans, and a fine series of illustrations from photographs, showing both characteristic scenery and types of settlements and dwellings, are included. This lavishness of illustration, contrasting so markedly with the painful economy to which we have become accustomed of late, has been rendered possible partly by the action of the Carnegie Trust in offering a guarantee against loss, and partly, it would appear from the Introduction, by that of Messrs. Bartholomew, who supplied the coloured maps. The result is to make the book an important addition to the comparatively small number of detailed studies of parts of the British Isles already in existence.

The book will, we think, be primarily of value to geographers on the spot, and to those elsewhere who have already a wide knowledge of the country. The method of treatment adopted involves detailed studies of areas regarded as representative, with necessarily summary notes on other regions. This in turn means rapid transitions from one rural area to another, which must make the book difficult reading for those without detailed personal acquaintance with rural Scotland. This applies in particular to the sections dealing with the Highlands, and, despite what has been already said as to the wealth of illustration, we regret that the author has not supplemented those supplied by adding other sketch-maps bringing out points not easily seen on the large maps.

As an example we may cite the description of the road from the Spey valley to the Spean valley (pp. 102-104), which could have been easily made clear with the help of a sketch-map, but is at present difficult to follow. Again, the book begins with an interesting discussion of the shapes and sizes of the parishes of the Northern Highlands. Here a sketch-map is supplied, but it includes no names of any kind, and no form of key is provided, though this would not have been a difficult matter at least so far as the parishes named in the text are concerned. But criticism is perhaps out of place in regard to a book which has obviously been a labour of love, and has been based upon painstaking investigations, carried on over a number of years and in the intervals of other work, and we can but repeat our recommendation of the book to the notice of geographers. M. I. N.

The Mystery of Wansdyke.— Albany F. Major, O.B.E., F.S.A., and Edward J. Burrow. Cheltenham: Ed. J. Burrow & Co., Ltd. 1926. 11½ × 9½, pp. viii + 200. *Plans and Illustrations.* 25s. net.

Wansdyke, i.e. Woden's Dyke, is an earthwork which, it is believed, can be traced from near Portishead, on the Bristol Channel, eastwards as far as Inkpen Beacon, about 8 miles to the west-south-west of Newbury, a distance along the bank of some 80 miles. This earthwork is of very variable relief: in some parts of its course the crest of the bank may be 30 feet above the bottom of the ditch; in others the bank and ditch can be hardly traced, or may have disappeared altogether.

The late Mr. Albany Major, F.S.A., and his friend Mr. E. J. Burrow, devoted much time to an examination of Wansdyke on the ground, and this admirably printed and illustrated book is a record of their labours. Mr. Major unfortunately died during the final stages of the production of the book; and his friend and collaborator tells us that the book is, in a sense, a memorial of Major's life's-work, as he, perhaps "more than any archæologist of the day, had made a special study of Wansdyke, and several times traversed its complete length."

After two introductory chapters, the course of Wansdyke through Somerset is described; then the 14 miles during which Wansdyke runs along the previously existing Roman road from Bath, almost due eastwards; and then to Morgan's Hill and to Savernake. Of this section, near Shepherd's Shore, Mr. Burrow remarks that "it is more imposing in depth and width than at any other place along its whole length." As the dyke ascends the Downs towards Savernake it is very clearly defined, and Mr. Burrow's drawing shows the V-shaped notch on the skyline and the bank on its south side in a striking manner. Then we have a chapter on the course of the dyke through West Wilts, and then an account of its end near Inkpen Beacon, though there is, apparently, no evidence that it ever climbed the hill. An account is also given of an attempt to trace the so-called south-eastern branch, from near Bedwyn to Ludgershall; but Mr. Burrow states that, after careful examination of the disconnected lengths of earthwork along the line in question, he is unable to support the theory that this was a branch of Wansdyke at all.

The greater part of the book is devoted to detailed descriptions of the local topographical details, by which the dyke may be identified in its less obvious portions. The descriptions are accompanied by maps on the scale of 4½ inches to the mile, reduced from the Ordnance 6-inch, and are illustrated by admirably clean and clear drawings, by Mr. Burrow, which are a pleasure to study. Except for some trial diggings undertaken by Mr. H. C. Brentnall and the late Mr. Major, near Marlborough, in 1923-25—diggings with inconclusive

results—the whole examination of the dyke by the joint authors was a surface examination.

But the book contains many pages of useful extracts from the reports of past archæologists, amongst whom General Pitt-Rivers is *facile princeps*. It is to Pitt-Rivers that we owe the only definite information with regard to the date of this great earthwork. In 1889 he dug a section to the west of Old Shepherd's Shore and found, 5½ feet beneath the top of the rampart, an iron knife and an iron nail, and under the outer bank he found fragments of Samian pottery on the old surface line. In another section he found fragments of an iron cleat, on the old surface line; such cleats "formed part of the leather fastenings or sole guards of sandals." These finds, and also perhaps the fact that the dyke for 14 miles makes use of a Roman road, prove that its date is Roman or post-Roman.

To guide us further we have its name, Woden's Dyke, which would seem to indicate that it is pre-Saxon. We have also the fact that the ditch is always to the north of the bank, showing that it was intended for defence against a foe from that direction. Its formidable dimensions, for long stretches of its length, would seem to preclude the idea of its being a mere boundary bank.

These are the main facts about Wansdyke, but no fully satisfactory interpretation of them has yet been put forward. For the writers of the book under review the matter still remained a "mystery," although they were able to make one or two plausible suggestions. Mr. Major looked upon it as a composite structure, not all of one period. He thought that the downland section in Wiltshire might have been intended to close the gap between the Kennet and the Avon valley, and that such a fortification might have been useful during two periods of the Roman occupation. It is certain that it was not thrown up by the Britons against the Saxons, for it was made as a defence against the north.

The problem is a fascinating one, and perhaps one day a solution of it may be found. Meanwhile those interested in it may be advised to study this well-documented and beautifully illustrated book. C. F. C.

Geologische Karte von Europe, 1 : 10,000,000.— Berlin. Gebrüder Borntraeger. 1925. *M.*15.

This very well-executed geological map was prepared by Beyschlag and Schriel in 1925, and Dr. Stille of Göttingen has added to it a transparency upon which the main structural elements of Europe, together with Asia Minor and North Africa, are indicated and named. Twelve graded tints on the base map show the depths of the seas and oceans, while this map also shows the situation of overthrusts, and the maximum limit of Quaternary glaciation. Hence the combined maps afford data in convenient form for tectonic study.

Dr. Stille coins the names Ur-Europa (including Palæo-Europa), Meso-Europa, and Neo-Europa for the three major tectonic units of the continent. The first includes the hypothetical Laurentia, the Caledonides, the Baltic Shield, and the Russian Platform; the second includes the region of the Hercynian fold mountains (here termed Variscides); the third includes the Alpine and associated fold mountains, termed Alpides. With regard to the latter Dr. Stille makes no distinction between the Pyrenees and Caucasus, which are in Argand's terminology *plis de fond*, and those parts of the system which may be designated "new mountains," i.e. originating in the geosynclinal of Tethys: nor does he distinguish, with Argand and Staub, the Pennides, Austrides, and Dinarides. The picture presented is, indeed, in accordance with the simple generalization outlined by Kober in his 'Bau der Erde,' of a

mountain system consisting essentially of a pair of oppositely folded *Randgebirge*, which may or may not be separated by *Zwischengebirge*. The Caucasus and Anti-Taurus, for example, here appear as oppositely directed wings of such a system. For an outline study, however, which is all the author presumably has in mind, the absence of detailed analysis of the Alpides is of little moment. A misprint occurs in the spelling of "Variscisches" on the transparency.

E. G. R. T.

ASIA

Kings of the Hittites.— David George Hogarth: (The Schweich Lectures for 1924.) Oxford University Press (for the British Academy). 1926. 10 × 6½, pp. viii. + 68. *Map and Illustrations*. 6s. net.

Dr. Hogarth is, as ever, clear and interesting. In fact, the only point in his book which requires explanation is the title. His lectures were confined to the kingdoms founded or controlled in Syria by Hittite tribes after the twelfth century B.C., and as the Old Testament expression, "kings of the Hittites," is applied exclusively to these he has adopted it as a convenient title for his book. His work at Carchemish has specially qualified him for speaking with authority on the subject, and his classical knowledge on the one hand and extensive explorations in Asia Minor on the other add largely to the value of his conclusions.

Briefly, he believes that after the overthrow of the Hittite Empire in Asia Minor, about B.C. 1200, the Syrian portion of the Empire was occupied by invaders from Asia Minor who established a number of small states, the most important of which was apparently Carchemish. The invaders were known to the Assyrians as the Muska or Moschi, the Meshech of the Old Testament. They must have formed an important element in those "Northern" hordes who, as we learn from the Egyptian monuments, destroyed the Hittite Empire, descended upon Syria and attacked Egypt in the age of the Twelfth Dynasty. The old civilization of the Near East was saved only at the last moment when in a great battle by sea and land the Pharaoh Ramses III. defeated his enemy.

Dr. Hogarth prefers to call the older representatives of the Hittite peoples whose home was in Asia Minor by the name "Hattic," but they were known both to themselves and to their neighbours as Khattâ, Hittites. The name however was geographical, and neither racial nor linguistic. Different races and nations as well as different languages were included under it; the common factor was that they came from Asia Minor, and in early days had been governed or led to victory in Syria and Mesopotamia by Hittite princes. In the days of "the kings of the Hittites" the only state in Syria which could be called Hittite from a purely linguistic point of view was that of the Khatu-nâ in the Plain of Antioch, where the royal names resembled those found at the Hittite capital Khattusas, the modern Boghaz Keui.

Dr. Hogarth's conclusion that the Hittites of Carchemish were Moschians (whom I should derive from the eastern extremity of the Black Sea) agrees with the results of my reading of the Hittite hieroglyphic inscriptions. In these both at Carchemish and elsewhere the kings and high priests call themselves and their subjects "Moschians," and I have therefore proposed to term the inscriptions in question "Moscho-Hittite." That my reading of the texts is in the main correct has now been established by a recently published tablet from Boghaz Keui, in which the same proper name is given in both cuneiform and Hittite hieroglyphics, the two corresponding letter for letter if the values I have long since assigned to the hieroglyphs are accepted.

Dr. Hogarth subjects the artistic monuments of the Hittites in Syria to a close examination, and shows that at least three periods can be detected in them. He also concludes that "the Cappadocian and the Syrian branches of Hittite art were derived independently of one another from some common stock, and that subsequently they developed in independence."

Most of the hieroglyphic texts belong to the same period—the twelfth to the sixth centuries B.C. Those which centred at Tyana (now Bor) form a special group, distinguished by an approach to alphabetic writing. They all date from the seventh century B.C. and partly influenced, partly were influenced by, the contemporaneous Old Phrygian script. The earliest texts yet found are those from Hamath. But I doubt whether we can make the use of incised or relieved writing a test of relative antiquity, as Dr. Hogarth would do. It is true that most of the incised inscriptions we possess belong to a late epoch; but it must be remembered that they are still limited in number, and that our two earliest examples of the hieroglyphic script are incised on the clay tablets of Boghaz Keui.

Those who wish to know what is the present position of the "Hittite problem" from a sane and scholarly point of view cannot do better than read Dr. Hogarth's book, the value of which is much enhanced by the numerous well-chosen photographs with which its pages are enriched.

A. H. SAYCE.

Revolt in the Desert.— "T. E. Lawrence." London: Jonathan Cape. 1927. 9½ × 6½, pp. 446. *Illustrations and a Map.* 30s. net.

The air of mystery and rumour which attended the issue of T. E. Lawrence's 'Seven Pillars of Wisdom' some weeks ago to the privileged few who had subscribed for it, and the phenomenal prices at which copies of the work were immediately advertised for sale, naturally generated a very keen interest and anticipation among the less favoured public in the promised issue of an abridged version. This we now have in the 'Revolt in the Desert.'

Not a few of Lawrence's friends and associates of the war had become a little wearied by the stream of gossip, sensational and otherwise, which had been fitfully current during the long period of waiting for his anabasis, and were prepared to be disappointed with the result when it came; but they need not have been. The drama which has at length been unfolded to us is an amazing one; we hear a good deal of "best-sellers" nowadays, but, sensational fiction apart, no book within my memory has been greeted as this has with such frank enthusiasm by every sort and condition of reader. To those of us familiar with the slim boyish figure and seemingly fragile frame of T. E. Lawrence it almost passes comprehension that he should have been able to weather such infinities of moral strain and physical suffering, and have come through the ordeal, if not scatheless in body and mind—that we can hardly believe—at any rate without any permanent symptoms of physical wreck.

Literature is indeed fortunate that the prime actor in this incomparable melodrama of the war should have been possessed of such qualities of style and diction as were worthy of the tale he had to tell. 'Revolt in the Desert' has been compared to Doughty's classic book of travel 'Arabia Deserta.' I can see no parallel myself, nor can it be said that the style of Lawrence's work, high though it is, is of quite the same quality all through; he is sometimes bizarre, and sometimes seems affected, but there is no lack of fine writing, and some of his word pictures of Arab celebrities who shared his fortunes—Faisal ibn Hussein, now King Faisal of Iraq; Auda Abu Tayi, the grand old warrior of the Howeitat; Tallal el Hareidhin, and his dying war-cry; Nuri Shaalan,

the great Ruwalla chief—will surely leave an indelible impression on the reader's memory.

In the case of a volume so completely fascinating as a whole the wayward eccentricities of the writer in matters of detail will easily be forgiven; but they cannot be altogether ignored by the reviewer. The variform and capricious spelling of names, familiar and unfamiliar, regarding which we are regaled with an amusing Publisher's Note at the beginning of the book, is needlessly slipshod, and may try the patience of the oriental scholar, but it will probably pass quite unnoticed by the general reader, and need not be taken too seriously. The volume has however one real blemish, to my mind—or, shall we say, inconvenience. We are dealing, be it remembered, with an abridgment of the 'Seven Pillars of Wisdom,' and I could wish that the blue pencil had been more liberally employed in the process. The author seems to go out of his way at times to affect a coarseness, even a vulgarity of expression, which we could well have been spared without the least prejudice to the interest or style of the context. I remember it being said of Emile Zola that he "admittedly wrote with great fidelity, but without any of that reticence or sense of decency which had restrained all previous writers when dealing with mire," and I cannot help recalling that criticism now, though it is not entirely apposite. No doubt we live in a less squeamish age than did Zola, but Lawrence's splendid saga of war and adventure would have been ideal pabulum for the sons and daughters of this generation were it not just for this Zola touch. I am fain to hope that in a later edition the inconvenience may be eliminated; meanwhile 'Revolt in the Desert' is a book which every grown-up will read with the keenest interest and enjoyment.

A number of portraits are included in the volume—of British officials and Arab celebrities. No two persons ever seem to agree about likenesses, and personally I cannot enthuse about these. To me, certain of them are good; others perhaps recognizable; one or two even libellous, to my thinking, and I can but offer sympathy to the victims.

One word in conclusion regarding the author's *nom de plume*—"T. E. Lawrence" with inverted commas! I believe he is now T. E. Shaw, of the Royal Air Force; but he was T. E. Lawrence during the Arab Revolt, so surely the *alias* boot should be on the other leg.

P. Z. C.

A Servant of the Mightiest.—Mrs. Alfred Wingate. London: Crosby Lockwood. 1927. 7½ × 5, pp. 352. *Illustrations.* 7s. 6d. *net.*

Oriental history is notoriously long-winded, and Mongol history stands out in wearisomeness even among oriental histories. Mrs. Wingate has had, therefore, a tedious task in bringing the story of the rise of Mongol power within the scope of a novel and in presenting it attractively. And she has not always succeeded in her task. There are many exasperating pages which one would fain miss. Yet in the main she does succeed in making us feel the impression which the vast open space, and the clear still sky, and the bracing air of Mongolia must have made upon its inhabitants.

One of the great marvels of history is the way in which an uncultured nomadic people issuing from the steppes and deserts of inner Asia overran nearly all Asia and much of Europe and established dynasties. Here, in the story of Chenghiz Khan, Mrs. Wingate has with great skill and power shown the influence of the steppe life upon the Mongols, how it hardened them and drove them to venture forth, and inspired Chenghiz Khan with a deep and strong religious faith in his destiny. He believed he was a servant of the

Mightiest, commissioned to conquer the world. And he rode forth and very nearly did it.

F. E. Y.

Farrer's Last Journey : Upper Burma, 1919-20.— E. H. M. Cox. London: Dulau & Co., Ltd. 1926. 9 × 6, pp. xix. + 244. *Twenty-eight Plates, Sketch-map.* 18s. net.

Farrer's last two journeys in search of plants were in the tangle of mountains and valleys around the triangle in Upper Burma, north of the confluence of the N'mai hka and M'li hka, that together form the Irrawady. On the 1919 journey he was accompanied by the author, Mr. E. H. M. Cox. From railhead at Myitkina they marched to Hpimaw, overlooking the valley of the Ngawchang, and from this base explored the country to the west, north, and south, up to the top of the main Salween divide. The range of vegetation from the tropical valleys through the "ferocious" bamboo belts to the alpine meadows is graphically described, and the contrast is drawn between the vegetation of the south-western aspects facing the Monsoon and that of the protected northern slopes.

Farrer had no companion on his second journey, and the story is compiled from letters he sent to the author and friends at home, and his publications in the *Gardeners' Chronicle*. It is pointed out that it is difficult to trace his wanderings later in the year as his letters give no consecutive account, and that later still his letters lack description.

He visited Fort Hertz and finally made his base at Nyitadi on the Akayang, a tributary of the N'mai hka and farther north than he had reached in 1919. His main objectives here were the three passes of the Salween divide, the Shing-hong, the Moku-ji, and the Chawchi. His plan was to explore these areas thoroughly and in the autumn collect the harvest of seed from his discoveries during the flowering season. This purpose he was unable to fulfil, for he died at Nyitadi on October 17, after a few days' illness and before he could accomplish the last part of the programme.

Throughout the book the author paints a striking character study of Farrer, his love of what was both his work and hobby, and his enthusiastic interest above all for the Primulas. The general vegetation is pictured as fierce and relentless with "an overpowering strength." As the story draws to its end the reader almost feels the ever-present clouds and mists of these mountains which gradually closed in over the traveller until, at last, they overpowered him and enshrouded his resting-place for ever.

The chief interest of the book is for the horticulturist in the series of pen pictures of the plants collected and of their immediate surroundings. The photographs of these and the general views are excellently reproduced.

T. F. C.

AMERICA

The Early History of the Frazer River Mines : being extracts from official correspondence, with an introduction and notes by His Honour F. W. Howay. (Archives of British Columbia. Memoir No. VI.) Victoria, B.C. : Provincial Library. 1926. 10 × 6½, pp. xvii. + 126. *Ten Illustrations.*

This work records the sudden birth of a colony, and the close of an epoch. For years the mainland of British Columbia was a preserve of the Hudson's Bay Company, and "Pro Pelle Cutem" was practically the only law. Serious cases were supposed to be tried in Upper Canada, which really meant that they could not be tried at all. Suddenly a mixed mining population poured into the country. Douglas (afterwards Sir James Douglas), the senior Hudson's Bay official, and also Governor of Vancouver Island, decided to represent the

Crown pending authority from England for the creation of a colony on the mainland.

The main difficulty lay in the selection of magistrates, and Judge Begbie, on arriving from England, found some queer subordinates. One of these quarrelled with a colleague over the conduct of a case, and threw prosecutor, witnesses, and his rival's constable—everybody but the accused persons—into the local gaol; for this he enrolled one McGowan, a notorious desperado who had once been elected a Justice of the Peace in California, "where he had attained political power, or rather power politically, by means of the famous ballot box with false bottom and sides." McGowan, however, soon became so amenable to British law that he refused to fight a duel in the Colony, and retired to uphold his honour in the State of Washington.

The rapid establishment of law and order appears, after such incidents, the more remarkable, but here the reader is led by the skilful arrangement of material to draw his own conclusions. Commander Mayne appears upon the scene, and Colonel Moody's Company of Royal Engineers, whose story Judge Howay has written elsewhere. R. P. B.

Medical Report of the Hamilton Rice Seventh Expedition to the Amazon (1924-25).—Harvard Institute for Tropical Biology and Medicine, No. IV. Richard Strong, M.D., George C. Shattuck, M.D., Joseph C. Bequaert, Ph.D., and Ralph Wheeler, A.B. Cambridge, Mass.: University of Harvard Press. 1926. *Seventy Plates (including One Map) and several Text Figures.*

The region investigated by the above scientific expedition comprises the greater part of the tropical districts of Brazil. "Portions to-day constitute some of the most unhealthy and dangerous regions to residents, from the standpoint of health, that exist in the tropics." "The region of the lower Rio Branco, from its mouth to the Rio Carrari, is probably one of the worst and most dangerous malarial regions in the world."

The area of the expedition's operations is a large plain completely covered by forest, except at the few clearings for the cities of Pará and Manáos and a few small towns and villages. A very large portion is semi-inundated. The great humidity, the continuous high temperature, and the extraordinary number of biting insects and animal parasites have had such a debilitating and enervating effect that in large areas of territory the population has been almost exterminated. Evidently the health conditions have grown worse, for it is stated that towns said to have once had a population of many thousands with some prosperity are now deserted, the buildings have rotted or been destroyed by the termites, and even the sites are being covered by the exuberant overgrowth of vegetation. The report points out that it is not alone man which suffers here, but that among the fauna generally diseases are very prevalent. Horses, for example, which once were numerous, have extraordinarily decreased in number through the disease called Mal de Caderas, or Quebrabunda—produced by a Trypanosome in the blood. The prevalence of this disease is, it is suggested (p. 93), due to the cupidity and culpable carelessness of human agents.

The report is by no means exclusively medical; there are many pages devoted to zoological and botanical studies. Chapter ii. is devoted to a description of "The Amazon Forest"—its monotony, its gloom and silence, and its treacherous dangers. Nothing in the description invites any but a scientific enthusiast to visit such a land. Many of the figures are beautiful—chiefly the forest scenery. There are two interesting pictures (Plate IX.) of "Ant

gardens" formed by certain *Camponotes* ants, which look like gardens in the air several feet in diameter. There are also interesting groups of the Maku Indians and their dwellings (Plates XIV.-XVI.), but most of the illustrations are distinctly of purely medical interest.

The expedition was well equipped for the latest methods of pathological and biological investigation. Laboratory investigations were conducted at the laboratories of Dr. W. Thomas, the local representative of the Liverpool School of Tropical Medicine at Manáos, and observations were made at the hospitals and clinics at that city and at Pará.

The prevailing and the worst disease is malaria. It is difficult, it is stated, in some parts to find a single individual who does not show signs of chronic malarial infection. Malignant tertian occurs in over 50 per cent. of cases. Splenomegaly is of course very prevalent. There is a very full discussion (chapter viii.) on enlargement of the spleen generally.

Other common diseases are ulcerative processes of the skin due to various kinds of *Spirochaetes*. Tropical ulcer and Leishmaniasis are very common. Tropical sloughing phagedema, due apparently to *Spirochata Schaudinni*, is far the commonest form of ulceration. This is illustrated by many plates. A newly discovered "Dermal granulomatous spirochaetosis" is here described and illustrated. Syphilis is very common and also leprosy. Of the latter a recent report states that in Pará there were 2400 cases, or about one to every hundred inhabitants. The great majority of cases of leprosy are not isolated, and sufferers freely use the public conveyances. A good deal of treatment has been carried out in places, and many thousands of injections of Chaulmoogra oil have been given. Hook-worm disease is very common, and beri-beri, dysentery, typhoid, and small-pox all occur not uncommonly. Yellow fever, once common, is now, thanks to preventive measures taken at Manáos, much less frequent, and relapsing fever and hæmorrhagic jaundice also seem happily to be scarce. One variety of Trypanosome causes chagas disease. We read, too, of stinging ants, stinging and very poisonous black flies, and even stinging caterpillars.

Part II. is devoted to medical and economic entomology, and deals exhaustively with diseases in animals; and Part III. contains observations on the Branco, Uraricuera, and Parima rivers, and includes an illustrated article upon a new tapeworm (*Atriotania parva*).

It will be seen that this is a book for the tropical specialist and not for the general reader. For the former the book is essential, and the general get-up is so excellent and the abundant illustrations, including many coloured plates of microscopical appearances, are so beautifully reproduced that it forms a most valuable addition to our special knowledge of tropical disease in general and of Brazil in particular.

E. W. G. M.

Naturalist's Guide to the Americas.— Prepared by the Committee on the Preservation of Natural Conditions of the Ecological Society of America. Edited by Victor E. Shelford. London: Baillière, Tindall & Cox. 1926. 9½ × 6, pp. xv. + 761. *Sketch-maps*. 45s. net.

The Ecological Society of America is a national organization of persons, most of whom are connected with universities or colleges, and all are interested in the preservation of natural conditions. It publishes the journal *Ecology*, which is largely devoted to contributions on the original fauna and flora of America and on their conditions of existence. Ten years ago a committee was appointed to make a list of all preserved and preservable areas in North America in which natural conditions persist. The committee, which now

numbers some seventy-five members resident in different parts of the continent, has accomplished the first part of its task in producing the 'Naturalist's Guide to the Americas.' So far as one can see, the catalogue is complete. We with our few puny acres of Nature Reserves cannot help envying these rich folk their Parks of thousands of square miles. There is a short account of the physiography of each State, Province, or Territory, followed by a general survey of the fauna and flora, together with a complete bibliography, which will be valuable to travellers as well as to naturalists. The numerous sketch-maps are reasonably clear.

Report of the Preliminary Survey of the Mazaruni and Puruni Diamond Fields, British Guiana, March-December, 1925.— H. J. C. Conolly. 13 x 8½, pp. vi. + 103. London: The Crown Agents for the Colonies. [N.D.] 11 *Figures*, 11 *Maps*.

Diamonds were first found in the Puruni district of British Guiana in 1887 or 1888, but it is mainly in recent years that the output has become of significance in the world's markets. Up to the present over 1,000,000 carats have been obtained, and in 1924 and 1925 the production, whilst less than that in 1923, was about 160,000 carats. The diamonds are all alluvial stones, and are obtained mainly from the Mazaruni and Puruni fields. In the first part of the Report (Introduction, Economic Considerations and Economic Conclusions) it is a little difficult to separate the facts of importance from a mass of generalities and platitudes. In the succeeding section on Geology, which occupies the bulk of the Report, the author appears to be on more familiar ground, and gives a very useful survey of the general geology of British Guiana. There is a fundamental Gneiss-Granite Complex with an associated Volcanic Series, believed to be entirely pre-Cambrian; later intrusive rocks of both basic and acidic types; a Sedimentary Series of unknown age which was deposited along rivers and in the shallower parts of a sea or lake on the peneplaned surface of the basement complex; and the all-important superficial deposits which yield the diamonds. Details are given of the various workings, and the opinion is expressed that there are extensive resources in the proved diamond-bearing area of 1200 square miles. The importance of the diamond and other mineral-bearing deposits in affording a necessary stimulus to general development of the country is emphasized, and it is considered that there should be legislation to prevent careless washing of deposits, even though the annual output should be lessened thereby.

L. D. S.

The Conquest of Brazil: a survey of the land and its people.— Roy Nash. London: Jonathan Cape. 1926. 9 x 6, pp. xvi. + 438. 8 *maps and 77 Illustrations*. 18s. net.

No one who is familiar with the resources of the vast territory of Brazil will dispute the author's contention that the country may well in the future vie with the greatest in productive importance. Now, however, as in the past, its development is hindered by short-sighted economic policies—e.g. that of inter-state export duties—by a ruthless exploitation of the natural resources, and by a lack of sufficient population to colonize the interior or even the coastal regions effectively. Mr. Nash being an American, his remarks on the population question are of special significance. He thinks that Brazil should embark forthwith on an active immigration policy, drawing from all available sources in Europe and Asia. The United States may not always be prepared to act as a benevolent protector. "Who can view the tendency of the United States increasingly to concern herself with the affairs of Mexico and the republics

of the Caribbean, and prophesy what a nation two hundred million strong, in the year 2000, may do if economic power continue to gravitate into her hands?"

Of the four main sections, supplemented by a full index, into which Mr. Nash's ample volume is divided, the first, which is mainly historical, and the last, comprising four short chapters under the main title of Looking Ahead, are perhaps the best. The author has a flair for the salient features of the picturesque historical setting in which the Brazil of to-day has developed, and knows how to combine the whole into a dramatic narrative. His chapters in the concluding section are from the reader's standpoint all too short, for here he allows his gift of imagination to work freely upon a vast store of knowledge accumulated through wide reading on his subject and through travel and residence in Brazil. The two intermediate sections of the book deal in order with "the essential facts of human geography" and with "some essentials of human happiness." The latter is mainly descriptive, but gives us some new material concerning the domestic life and the social problems of the country. The more or less purely geographical part of the book, however, comprising some 130 pages, or a third of the text, appears to call for some criticism. Though obviously based upon some original observation and on recent as well as older material, the account lacks that discrimination between the essential and the unessential, that soundness and logical arrangement of ideas which contribute to vigour and scientific poise in the finished product. Mr. Nash, in a word, is more fortunate in describing people and their doings than in giving a picture of their environment.

To English readers the author's style is apt to be perplexing. He cannot present anything in simple direct language. His matter is often so wrapped up in far-fetched figures in which American phraseology and allusion abound that a serious disentangling task is thrust upon the reader. Yet at its best the style is graphic and picturesque, and shows what the author can do when he trims his medium to his subject.

E. W. S.

AUSTRALASIA AND PACIFIC ISLANDS

In *Savage Australia*.—Knut Dahl. London: Philip Allan & Co., Ltd. 1926. 9 × 5½, pp. xii. + 326. *Illustrations and a Map*. 21s. net.

The author of this book spent some two years (1894-96) in wild North-West Australia as a collector of specimens for the Zoological Museum of the Norwegian University. On his return to Europe he published an account of his expedition in the Norwegian language, and the issue of a new edition led to the preparation of a translation, done by himself with the aid of two English "supervisors." It may be said that the translation leaves little to be desired, the author's style in a foreign language being noteworthy for its lucidity and accuracy, and being free from any suggestion of the dry-as-dust.

Arnhem Land and Dampier Land were the regions selected for the author's collecting grounds, and he presents to us a vivid picture of the country and its inhabitants over thirty years ago. The conditions have probably not altered essentially since that time, for even then the aborigines had lost much by contact with Europeans and Asiatics, and the author was especially struck by the evil influence of the Chinese. Nevertheless there was still opportunity for the study of aboriginal culture, and although the main object of the expedition was the collection of zoological specimens, the author did not fail to make a number of interesting observations on human life and customs. He was fortunate in escaping regrettable incidents, but if the country was a collector's paradise, the human inhabitants were not angels. The extent to which the

natives had been degraded by civilization varied in different parts, and not everywhere had they become so enlightened as to profit by the sale of the skulls of deceased relatives for flour and tobacco.

The author was very successful in his main object, and he secured and sent home large numbers of specimens, including many new species of animals. His account of his search for a marsupial called "wogoit" by the aborigines, ending in his final success in obtaining specimens of a new phalanger (rock phalanger—*Pseudochirus dahlí*), gives a vivid picture of the keen collector on the trail.

Those who are interested in anthropology, zoology, and the climatic and topographical variations in an untamed land will find no dull pages in this book, which is a record of personal experiences from beginning to end.

H. S. H.

The Wild Animals of Australasia, embracing the mammals of New Guinea and the nearer Pacific Islands.— A. S. Le Souef and Harry Burrell. With a chapter on the bats of Australia and New Guinea by E. Le G. Troughton. London: George G. Harrap & Co., Ltd. 1926. 9½ × 6, pp. 388. *Illustrations*. 25s. net.

Students of Vertebrate Zoology will be grateful to Messrs. Le Souef and Burrell for bringing into one volume a concise account of the mammals of Australasia. In the lay imagination the continent is inhabited only by kangaroos, dingoes, and imported rabbits. The actual population is something like 400 species belonging to seven distinct groups: bats, wild dogs, seals, dugongs, rodents, marsupials, and monotremes. The first five of these groups show near affinities to their relations in other parts of the world, and it is in the last two groups that the most remarkable creatures are found. Though the marsupials have adapted themselves to many different kinds of environment, they have advanced very slowly in comparison with the mammals of other continents where competition was keener. "The majority of them seem destined quickly to disappear, not so much from the opening up of the country and settlement of the land as by reason of the introduction of wild animals from other parts of the world. . . . An Australian animal probably could not establish itself in America; an American animal would be hard pushed to gain a living in Europe, or a European animal in Africa; but reverse the order and we have the avalanche. The case is exactly paralleled by that of the European and the aborigine among mankind." The book is well illustrated with photographs.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

New Dynamical Wave-Theory of the Tides.— [Captain T. J. J. See.]

Published and sold by the [U.S.] Hydrographic Office. (H.O. No. 207.) 9½ × 6, pp. 91. *Charts*. 60 cents.

This pamphlet, prepared by Captain T. J. J. See, bears the extended title: "Discovery of the physical cause of the variation of latitude, with calculation of the period and amplitude of the polar motion, from the observed oscillations of the unsymmetrically situated ocean hemisphere, including a revised cotidal map of the oceans, now shown to be oscillating in synchronous world-waves copieriodic with the disturbing forces, Laplace's principle, together with an investigation of other laws of the motion of the sea hitherto unknown, and an improved method for calculating the rigidity of the Earth."

To the present reviewer the pamphlet appears to contain no valid con-

tribution to the scientific knowledge of the subjects treated. On the other hand, it does contain many fallacious arguments leading to results which are certainly erroneous. The author appears to have read much of the literature on the dynamical theory of the tides and the variation of latitude, and to have failed to understand a considerable fraction of it. This literature he discusses at some length, and his negative criticisms contain much that is true. But these valid criticisms are by no means new, and, in fact, for a long time have formed a spur to research.

It is a matter of some surprise that such a production could be published under the authority of the Secretary of the U.S. Navy.

J. PROUDMAN.

Treatise on Sedimentation.— W. H. Twenhofel and Collaborators. London: Baillière, Tindall & Cox. 1926. $6\frac{1}{2} \times 9$, pp. xxv. + 661. 61 *Plates and Text-figures*. 34s. net.

This is the work of a committee appointed by the National Research Council (U.S.A.), and it is not surprising that the different sections should be of unequal value. While a geologist may find much to criticize in detail, to a geographer it should prove a valuable work of reference, as it brings together the results of extensive researches which might otherwise never come to his notice. An idea of the treatment may be obtained from the titles of the chapters: "Sources and Production of Sediments," "Transportation, Deposition, Diagenesis and Lithification of Sediments," "Important Conditions [topographical and climatic] modifying Sedimentary Processes," "Sediments and Organisms," "Products of Sedimentation," "Structures, Textures and Colors of Sediments," "Environment or Realms of Sedimentation," "Field and Laboratory Studies of Sediments." Chapter v. forms nearly half of the book, and gives a systematic account of all the various types of sediment: the section on Carbonaceous sediments by Dr. David White may be mentioned as particularly complete and well arranged. Chapter vi. is next in length, and is noteworthy for a very thorough treatment of ripple-marking, mainly by Dr. Kindle; there is also an interesting discussion on the colours of sediments by Mr. Blackwelder. The remaining six chapters are comparatively short.

A. M. D.

HUMAN AND HISTORICAL GEOGRAPHY

The History of Atlantis.— Lewis Spence. London: Rider & Co. [1926.] $9\frac{1}{2} \times 5\frac{1}{2}$, pp. xvii. + 238. 16 *Plates*. 10s. 6d. net.

This volume is the third of a series by the same author, the two former being 'The Problem of Atlantis,' reviewed in this *Journal*, vol. 64, p. 181, and 'Atlantis in America,' reviewed in vol. 66, p. 466.

In the present volume the author endeavours to give an actual history of Plato's lost continent. He admits in his preface that such an attempt may be considered rather presumptuous. We cannot help feeling that it is so. Mr. Spence has certainly presented a good case, but not a convincing one. In chapter v., "The Geography of Atlantis," he summarizes the data put forward in his former works for the existence of a North Atlantic continent in late Pleistocene time. In doing so he follows M. Termier very closely. Practically no mention, however, is made of the numerous geologists who doubt the existence of such a continent at a time when the Earth was inhabited by early man. The weakness of this chapter upsets the arguments of the remainder of the book.

The author first considers the sources from which Atlantean history may be

derived. The Platonic writings are naturally discussed at some length, as are also those of Diodorus Siculus and other writers who dealt with the question of Atlantis. Plato's account suggests to the author that Europe was invaded about B.C. 9640 from the west. Mr. Spence, referring to the great work of Penck and Brückner, 'Die Alpen im Eiszeitalter,' finds that this date corresponds with the suggested date of the Gsnitsch stadium of the final retreat of the ice. He then goes on to say that the date also agrees with the arrival in Spain of the Azilio-Tardenoisian race, who, the Abbé Breuil believes, came from "circum-Mediterranean" localities. The author indicates certain lines of evidence of their having come by sea from Atlantis.

The remainder, and major portion, of the book is devoted to an historical account of the Atlanteans. Since no such place as Atlantis now exists, the sources of such a history must be derived elsewhere—Western Europe, and perhaps America, to which places the author assumes Cro-Magnon and Azilian man migrated from the former land-mass. By drawing upon what is known of these peoples, together with the writings of Plato and others, Mr. Spence has written chapters on the Kings of Atlantis, the traditions, life, state and polity, and religion of the continent. He is on safer ground when he touches on the animal-life, but is very daring in the two last chapters which deal with Atlantean colonies and the Culture-Complex of Atlantis.

As was pointed out in a review of one of his earlier works, Mr. Spence must first present much more definite evidence of an Atlantis existing in human times before he proceeds to draw conclusions from the supposed spread of its inhabitants. But the value of such a book does not lie wholly in the absolute accuracy of its subject-matter. Whether or not his readers are convinced of the reasonableness of his assumptions, they will all admit that his ideas are interesting and stimulating.

J. A. S.

The Acquisition and Government of Backward Territory in International Law.— M. E. Lindley, LL.D. London: Longmans. 1926. Pp. xx. + 377. 21s. net.

This treatise is a compendious analysis of the principles governing the acquisition of sovereign rights over land and sea, by means other than those of conquest in war or cession between sovereign states. Little of the World, indeed, now remains for acquisition, and nearly all territories are admitted to be subject to some sovereignty, but the treatise is not on this account of merely historical interest. Questions still arise as to who is rightful sovereign, and these demand the consideration not only of the local facts but also of principles already sanctioned in analogous cases. A notable instance is the recent judgment of the Judicial Committee in the case of the Labrador boundary (*sub judice* when Dr. Lindley's book was published), which has agitated the legal minds of Canada and Newfoundland for more than twenty years. A wealth of legal argument, largely based on analogies, was brought to bear on the interpretation of the word "coasts" in a Governor's commission of 1763, and the decision carried with it jurisdiction over more than 100,000 square miles of territory.

The acquisition by civilized Powers of lands, waste or inhabited by native tribes, is the subject of many of the cases recorded. Effective occupation is required, and claims founded on first discovery alone have been invariably rejected. The difficult cases arise where the occupation has not been continuous. Next may be noted the question whether the subject of a civilized Power can become an independent sovereign; here the leading case is that of

Raja Brooke of Sarawak. He could not and did not wish to divest himself of his status as a British subject, while the British Government strove to avoid the responsibilities of sovereignty. A solution was ultimately reached by the convenient method of Protectorate.

The passages relating to the acquisition of sovereignty over the sea present some problems not yet fully solved. The claims of Spain and Portugal under Papal Decrees, as also those of England in respect of the Four Seas, have long been abandoned: the right to a territorial belt is acknowledged, but the 3-mile limit has become obsolete with the cannon range on which it was founded, and the extent of sovereignty over bays has been settled only in some cases and for some purposes. In regard to commercial rights, the claim of Ceylon to her pearl fisheries, founded on prescription, has been admitted, while that of the United States to an exclusive seal fishery in the North Pacific was rejected on arbitration.

A large portion of the book is rightly devoted to the origin, growth, and powers of chartered companies. Most of the charters were granted in respect of countries having no settled government; they gave powers of occupying the country and exercising all the powers of government. That of the first East India Companies, on the other hand, affecting civilized states, gave monopoly of trade only. The British Government, however, asserted its sovereignty as soon as territory began to be acquired. Nearly all the others have proclaimed the reservation of sovereignty, an exception being that of the North Borneo Company. Here again the British Government strove to maintain an impracticable compromise, under which they could interfere with the administration while the suzerainty remained with the native sultans. This situation also was in a few years terminated by a Protectorate.

Some of the problems stated by Dr. Lindley require more discussion than he has been able to give them. It may also be regretted that in his chapters on "The Exercise of the Sovereignty" he does not describe the mode in which the British Government legislates for its administrative Protectorates. He should have pointed out that the power to legislate for these non-British territories rests, under the Foreign Jurisdiction Act, not with Parliament, but with the Crown alone. This was so in the case of Kenya, Uganda, etc., before they became colonies. In the case of protectorates annexed to British colonies, as in West Africa and elsewhere, the power has been delegated to the Colonial legislatures. As a whole, however, the work shows the results of much patient research, the arguments are well summarized and fairly weighed, while the marginal notes supply references guiding the reader to the sources from which the text is derived.

A. G.

GENERAL

Wine and Wine Lands of the World.— F. H. Butler. London: T. Fisher Unwin (E. Benn, Ltd.). 1926. 9 × 6, pp. 271. *Illustrations.* 15s. net.

Mr. Butler's books always glow with enthusiasm and zest for living. He has a good time wherever he goes and wants his readers to share his enjoyment. This volume is no exception. In a hurried survey he takes us from one vine-growing land to another, telling a little of his personal experiences and impressions and a good deal about the manufacture and qualities of the various wines and spirits. He has a good word to say for all, and even if the book is mainly a series of notes on wines with a few anecdotes thrown in, one lays it down regretfully, wishing it were longer, for it makes cheery reading and is full of sunshine. Some of the chapters are very short, but nearly every alcoholic

beverage gets its share of praise. It is of course a mistake to say that traces of the vine are found in the "earliest strata of the Earth's crust," but the author's enthusiasm for the grape and his desire to give it a long lineage may be gauged from his belief "that the discovery of natural fermentation was the greatest step ever made in the upward progress of the human race." This eulogy of wine includes a number of drinking songs and toasts, a long list of wines suitable for various dishes, and a catalogue of twentieth-century vintages.

R. N. R. B.

To America in Thirty-nine Days.— J. Biggs. The Village Press, Idbury, Kingham, Oxon. [1926.] 8 × 5½, pp. 26. 3s. 6d.

'To America before steamships' is the alternative title which appears on the cover of this neatly bound booklet that consists of extracts from the diary of Mr. J. Biggs, who went to America in 1837. The extracts are printed *in memoriam* by his daughter. They give a vivid account of the impressions of a man who had no mean powers of observation and criticism. "I dislike the country, I dislike the people, their morals, and their manners," he wrote: but nevertheless he found much to appreciate, and the size and speed of the early steamboats on the Hudson river filled him with wonder.

R. N. R. B.

Goode's School Atlas : Physical, Political and Economic. For American Schools and Colleges.— J. Paul Goode, Ph.D., Professor of Geography, University of Chicago. Chicago and New York: Rand, McNally & Co. 1925. 11 × 10.

In his preface the author says, "Much of the material set down in the Atlas is of fundamental importance in a general education." The claim is thoroughly justified, and indeed we can well imagine the ordinary man, and not merely the student of geography, deriving both pleasure and profit from a study of its pages. The great merit of the Atlas is that it is geographical in the best sense of the word; physical features, climate, vegetation, and political and economic conditions are all represented, and in such a way that from this Atlas alone an intelligent person could learn more geography than from many a more elaborate work. Naturally most attention is given to North America, for which, in whole or in part, there are over one hundred maps. Europe comes next, but, it may be suggested, receives somewhat inadequate treatment.

The maps are as a rule clearly printed, though in some cases at least the colours are not well chosen, and artistic finish is not the conspicuous merit of the work. On the economic map of West Central Europe political frontiers and coal deposits are alike shown in red with somewhat confusing results. The small economic and population maps have been generalized to such an extent that in some cases they are almost deceptive, and we note that on page 68 the population of Denbigh is shown as over 256 to the square mile, while on page 69 it is shown as less than 250. The spelling of European place-names is not quite satisfactory: thus Krakuv is neither the conventional nor the true Polish form (Kraków), nor is it strictly phonetic. The interrupted homolographic projection, on which the world maps are drawn, has never appealed to us, but we like it least on page 15, where South America is split in two.

Notwithstanding some defects the Atlas is a notable piece of work if only for the fact that it is, as far as we are aware, the best which has yet been produced in the United States.

J. MCF.

THE MONTHLY RECORD

EUROPE

The Till Valley, Northumberland.

AS the type of a Border area, the valley of the Till, a tributary of the Tweed, is studied by Mr. H. Houston in the *Scottish Geographical Magazine*, vol. 43, No. 2, 1927. The valley is the more westerly of the two lowland routes from England to Scotland which together form the "Cheviot Gate," being separated from the other, along the Northumberland coastal plain, by a ridge of sandstone hills between 450 and 800 feet above sea-level. On the west the valley is buttressed by the Cheviot mass rising to an extreme height of 2800 feet. The geology of the region is complex. There is boulder clay over Carboniferous rocks in much of the valley, but its wide lower part, known as Milfield flat, is alluvial. A large part of the granite dome of the Cheviots is included in the drainage area, and its fringe of rounded porphyrite hills flanks all the upper valleys and sometimes runs out in barren tongues into the richer plain. Rainfall is heavy in the hills, but in the valley itself is mostly below 28 inches a year, which however with the cool summer is ample for agricultural needs. The wetter hill country forms the sheep area, and there is little profitable cultivation above about 350 feet. Though the plainsman is no longer the prey of the hillman, the lives of the two are still essentially different, being separated by a transitional zone between the 400 and 600 feet contours. The Valley land is given up entirely to agriculture, and contains the central market town of Wooler, served by the road to Berwick-upon-Tweed (which relieves the congestion of the coastal road), and also by the railway opened in 1887. Women workers are very general on the Valley farms, and wear a serviceable but far from elegant dress. In the Hill land the life of the people is not much changed from that of a century ago. There are few facilities for transport, and the last 5 or 6 miles of the upland valleys have no made road whatever. The shepherd's house is the typical, and almost the only, dwelling. The shepherd and his family spend the summer herding sheep sent up from some farmer lower down the valley. Sheep migrate with the season, though there is no true transhumance in the Cheviots. In the winter months, when snow sometimes cuts off all communication with the outer world, the people occupy themselves with handicrafts. Taking the Till basin as a whole, the standard of living has been raised in the last hundred years, though the severe conditions have naturally been a handicap. The soil is too poor, and the area too small, to make it of any great economic importance, and there is no stimulus from any adjacent centre of population. Wool is the chief product, and in the Hill land, over fifty per cent. of the whole, sheep-rearing is the only industry. The people are neither English nor Scottish, but a Border folk. The lower part of the valley contains Flodden Field, and the whole was for centuries the arena of conflicts between English and Scots, the latter making much use of the inland route in order to avoid the great fortresses of the coast. In these affrays the Cheviotside Hillmen were ready to join hands impartially with either side.

The Pennines in the Ice Age.

Following on his paper on the early glaciation of Borrowdale, to which reference was made in the *Journal* for July 1926 (p. 90), Dr. Raistrick has dealt in a similar manner with the glaciation of Wensleydale, Scaledale, and adjacent parts of the Pennines in the *Proceedings of the Yorkshire Geological Society*,

vol. 20, Part iii., 1926. As in the former paper, he begins with a useful summary of previous work in this field, afterwards discussing in turn the distribution of drift deposits, striations, and erratics, the moraines and lateral drainage channels, and so forth, and attempting to reconstruct the conditions at maximum glaciation, and the phenomena during retreat. His main conclusions are as follows: In the west part of the area the movement of the ice was in a radial direction from a centre near the head of Mallerstang. It over-rode Mallerstang Edge in a north-easterly direction, joining the Shunner Fell ice to cross Swaledale, and in the Greta valley helping to divert the Stainmoor ice from the Tees valley into Weardale. Ice from Baugh Fell and Wild Boar Fell dominated the Rawthey valley, passing north and north-east by Ash Fell to the Vale of Eden, and then over Stainmoor. No ice entered the valleys of the Swale and Ure from the west except that of Baugh Fell, Teesdale, and the Vale of York. The later period of the glaciation was marked by suites of lakes impounded in the tributary valleys by the ice of the main valleys. Terminal moraines in the valleys are associated with definite river-terraces which show the retreat to have been periodic over the whole area. River diversions in the west are merely minor adjustments of the smaller tributaries, but in the east the Swale and Ure, with the Laver, have suffered considerable diversions from their pre-glacial courses. The diversion of the Ure at Masham took place during the glacial period, becoming permanent at its close, while that south of Masham to the Skell was temporary only, during the later stages of the retreat.

Landslides in the Vésubie Valley, Alpes Maritimes, 1926.

The causes and effects of the series of disastrous landslides last November in the valleys of the Vésubie and Paillon de Contes, Alpes Maritimes, are clearly analysed by M. L. Perriaux in the *Annales de Géographie* for March 1927. Though such events are usual in this region, these were on an exceptional scale, and confined with few exceptions to the valley of the Vésubie above St. Jean de Rivière. As the river here runs through Triassic argillaceous and gypseous beds, the slides, but for their rarity in the past, might be attributed to this fact. The inhabitants were inclined to attribute at least two to earth-tremors, but these were neither unusually severe nor frequent. The main cause must be found in the torrential rains of the weeks preceding November 21-24. At Nice in the previous thirty-one days 441 mm. had fallen, compared with the monthly average of 137 mm. for October and 97 mm. for November. At Venanson, at the head of the Vésubie valley, 1200 metres above sea-level, about 1662 mm. fell in the same period. This very nearly equals the average annual rainfall for that station. The worst catastrophe occurred at Roquebillière-Belvédère. Roquebillière lies at the foot of a hill of Triassic clays capped with morainic material. Above this hill the valley slopes steeply to Belvédère, the last stage having an incline approaching 45°. Here crevices appeared, and the landslide took place, precipitating two million cubic metres of viscid mud, clay, and erratics upon the village. The face of the slip was 250 metres high. The crevices had been noticed and warning given, but unfortunately the inhabitants had returned to their houses, eleven of which were destroyed and nineteen persons killed. Further rains filled the basin formed by the slip, and several days later the accumulation brought down cultivation-terraces and trees into the river. These terraces had been undermined by persistent excessive irrigation during the dry season. The features of the other slides were similar, the

saturated sub-soil sliding over the underlying steeply sloping beds. In the valley of the Madone de Fenestre, the slopes, saturated by the irrigation canal, slipped across the torrent itself and tore up the farther side, forming two lakes, which, though the torrent soon made its way through the obstruction, still existed a month later. A lake was also formed at La Muselle in the bed of the Vésubie, and was still 2 metres deep in December. The social and economic effects were serious: besides the loss of life, and damage to property, roads and tramways have been destroyed and much valuable cultivated and terraced land and timber have been lost. Moreover, the inhabitants of this inhospitable region are losing heart and emigrating to the Côte d'Azur.

AMERICA

Utilization of the Waters of the Great Lakes.

The complex question of the utilization of the water of the Great Lakes for various projects is discussed by Mr. Philip W. Henry in the *Geographical Review* for April on the basis of two reports. The first is by the Engineering Board of Review of the Sanitary District of Chicago, the second by the Joint Board of Engineers appointed by Canada and the United States to consider the St. Lawrence deep waterway (1927). Under the Boundary Water Treaty of 1910, Canada was permitted to utilize 36,000 cub. feet per second at the Niagara Falls, and the United States 20,000 c.f.s. This difference is said to have been made good by the insertion of a clause designed indirectly to cover the 10,000 c.f.s. which Chicago was then diverting from Lake Michigan.

The water diverted at Chicago is employed for three purposes: sanitation (water supply and sewage disposal), transport, and power development. To preserve the lake from pollution the sewage, after dilution with seven times its volume of lake water, is discharged by a canal into the Des Plaines River and ultimately into the Mississippi. After considerable litigation, Chicago, under a permit of the War Department, now takes 8500 c.f.s. from the Lake for dilution, and is required to build further treatment works and to reduce the amount taken for water supply, 1200 c.f.s. (This gives the high figure of 280 gallons per head daily.) The Engineering Board considers that until these further works are carried out the health of the population of the district, 3,426,000, requires an average annual diversion of 10,000 c.f.s.

The diversion canal is also a part of the "Lakes-to-Gulf" waterway, forming when further improved a 9-foot bargeway to Utica on the Illinois River. The section between Lockport and Utica, though possible without water diverted from the lake, would, it is said, cost \$30 million more than with a diversion of 10,000 c.f.s. It is further stated that "the actual monetary value of a cubic foot of water per second for power purposes in Illinois is greater than at Niagara." This may be so, but it does not remove possibilities of hardships at that end. The statement that two-thirds only of the net power available is produced at Niagara is also open to question. Regarding the St. Lawrence, the Chicago diversion is 4 per cent. of its total flow. The other States and Canada fear that the lowering of the levels of the Lakes will affect transportation, for the reduction of a foot in the draft of a freighter would mean a loss of \$6 million dollars per annum for the entire fleet. The Engineering Board of Review estimates that without remedial works the diversion of 10,000 c.f.s. will lower the level of the Lakes permanently, the greatest difference, in Lake Michigan, not exceeding 6 inches; the Joint Board calculates that the diversion of 8500 c.f.s. lowers Lake Michigan 6 inches. Undoubtedly, however, during the last decade the lake-levels have fallen

below the average: the mean levels are $2\frac{1}{2}$ feet lower than six or eight years ago, while the Michigan level is 4 feet lower than it was thirty-eight years ago. This is partly connected with the decreased rainfall and the greater evaporation since 1917, and is not likely to be permanent. The regulation of Lake Superior, the dredging of the St. Clare and Detroit rivers, the Welland and other canals account for the rest. The Joint Board recommend compensating works to remedy the Chicago diversion by restoring the levels of Lake Huron and Erie, at a cost of six million dollars. Some notes on the St. Lawrence deep waterway were given in the *Journal*, 66, 380-1: it is estimated that to provide a 25-foot channel on the Great Lakes and St. Lawrence would cost \$212 million, excluding the cost of the New Welland Canal, \$114 million, already in course of building, and without power development.

POLAR REGIONS

Protection of Fauna in Spitsbergen.

A proposal for the establishment of a national park in Svalbard (Spitsbergen Archipelago) to protect the animal life has been brought forward by Mr. A. Hoel of Oslo University, and is summarized in the *Norwegian Trade Review*, No. 1. Two difficulties arise at once: the inadequacy of the probable means for controlling so large an area, and the traffic already established in bear and fox furs, eider down, etc. The inhabitants now number from one to two thousand, and as the limits of expansion cannot be determined, the protective measures must be temporary. It is proposed that the hunting of reindeer by dogs or taking them in traps or snares shall be unlawful, also the use of poison or explosives in hunting or fishing. At the present time the reindeer are protected for a period of ten years. A close season is recommended for eider duck, and the protection of certain colonies for three years. Polar bears have suffered heavily of late, but as it is thought impossible to prevent them being shot by sealers during the summer, it is advised that hunting during the winter should alone be regulated. For similar reasons, the Arctic fox could be protected from tourists and others only during the time its pelt is worthless to trappers. As whaling would become profitless before the whales were totally exterminated, it is not necessary to protect them. It is also recommended that North-West Spitsbergen, between Ice Fiord and Dickson Fiord, should be declared a natural park, and all hunting and collecting prohibited there. This area contains the volcanoes and hot springs of Wood Fiord. Such regulations would of course be modified for scientific expeditions.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

River-Problems.

In vol. 20, pp. 301-325, of the *Proceedings* Yorkshire Geological Society Prof. E. J. Garwood's Presidential Address on "Some Problems of River Development" is printed. The author deals with some questions not often considered in English papers. He discusses amongst other matters the effects of the rotation of the Earth on river development, and reaches the conclusion that while this is an influence which may cause rivers to migrate laterally, its effects are often obscured by other and more important factors. But the chief problem with which he is concerned is, "Why do tributaries so often enter the main stream on the concave banks of the meanders?" He discusses the views of various writers on this subject, and reviews a good many cases illustrating this point. Prof. W. M. Davis writing on this subject concluded:

"Any river we now see meandering in an alluvial plain must have been already meandering a long time. Its individual meander curves must have advanced down the valley over considerable distances, and it is, I believe, chiefly for this reason that tributaries are taken in where the main stream bends towards them." Prof. Garwood agrees with this view in so far as large river meanders are concerned, but, as in the case of the River Mite, to the east of Wastwater, notes that it is not a complete explanation. The several small tributaries flowing into the Mite are all steep and their thalwegs are cut in drift. "As the main stream passes each of these tributaries it is deflected towards their mouths, so that they enter on the concave bank of each loop." In this case the tributaries themselves seem to have influenced the deviations of the main stream. The subject River Development was chosen because in 1924 Prof. Kendall in an address to the same Society suggested an investigation of the Yorkshire rivers by members of the Society. Students will find the paper very suggestive, and its value is enhanced by the addition of a useful bibliography.

A Humidity Map of the World.

In a recent number of *Petermanns Mitteilungen* (1926, Heft 7-8) Dr. Paul Hirth, of Görlitz, produces a coloured map of the world, with explanatory text, showing the distribution of humidity in relation to the necessity, or otherwise, for irrigation. The meteorological index is the quotient of mean annual rainfall in millimetres divided by mean annual temperature in degrees C., which is called the "Rain Factor" of a place, a correction being applied in the case of mean annual temperatures below 0°. The rain-factor of 40 is taken as the boundary between a dry and a humid climate. Tables are given of rain-factors for a large number of places all over the globe, places on the map having the same factor being described as lying on the same "isotide" (from the Greek *voris*, moisture). The sub-tropical desert belts all have a factor between 0 and 20, whilst portions of the equatorial regions on the one hand, and cool temperate or cold latitudes on the other hand, have a factor over 100. In the British Isles, Scotland, Ireland, and Wales are over 100, most of England and Central Europe under 100, London being given as 62. Of this map it may be remarked that, if it be taken strictly to represent how different countries compare in relation to the water requirements of crops and nothing more, it will prove instructive, but that it is wholly misleading if the rain-factors are interpreted in any wider sense. "Dryness" or "dampness" of climate is not the simple thing that this map would represent. A physiological dry or humid climate is a complex effect of amount and frequency of rain, frequency of fog, vapour pressure, and condition of soil. This effect is numerically indeterminate, but the nearest approach to a numerical expression—the best index of this totality of influences—is given by the ratio of rainfall to evaporation, not the relation of rainfall to temperature. It is anomalous, for example, to find, on the basis of the "rain-factors" in question, that countries like Siberia and Canada, which with their covering of dry crisp snow and low vapour pressure are commonly regarded as representing the type of a physiologically dry winter climate, are classed among the dampest regions on earth, whilst England with a distinctly damp type of winter climate, as denoted by relatively high vapour pressure, water-logged meadows, and common alternations of rain, fog, and wet snow, figures on the map in a less humid zone.

HUMAN AND HISTORICAL GEOGRAPHY

Italian Map Collections of the Sixteenth Century.

The collection of Italian maps brought together by Antonio Lafreri of Rome in the second half of the sixteenth century has attracted wide attention, and there has been a tendency to neglect other Italian collections of about the same date, or to wrongly associate them also with Lafreri. Detailed accounts of two such collections have now appeared almost simultaneously, the one contributed to *L'Universo* of March 1927 by Prof. Almagià, the other issued by Messrs. Quaritch as a description of a volume of the kind offered for sale by that firm at £1000. The two collections are generally similar, but that discussed by Prof. Almagià is by far the larger, containing 137 maps as against the 52 of Quaritch's. It had been briefly described by L. C. Moser in 1891, but had escaped general notice, and some search was necessary before the present whereabouts of the volume could be discovered. Its history is of some interest, as it had belonged to the well-known Italian geographer Adriano Balbi, by whose son it was presented to the then Austrian Lloyd, now the Lloyd of Trieste.

The collection is remarkable for its wealth of *geographical* maps as against the views and plans which form a large part of others of the time. An unusual number too—eight in all—are planispheres, and the volume is particularly rich in maps by Giacomo Gastaldi, including those most rarely met with. Like the Lafreri Atlas, it includes maps of many different sizes, some folded, others originally so small that wide margins have been pasted on to bring them to the size required for binding together. But there is no doubt that the set has come down in its original form, probably as it was brought together for a client of the firm which supplied it. It is equally certainly Venetian, for not only do most of the maps bear the names of known Venetian engravers, publishers, and booksellers, but the paper used bears in the great majority of cases watermarks used by Venetian paper-makers. In his detailed list Prof. Almagià mentions the watermark of all the maps which bear one, that most represented, both on the maps and the marginal strips, being No. 56 of those figured in this Journal in May 1924. The name which occurs most frequently is that of Ferrando Bertelli, whose well-known shop was at the "Libreria del S. Marco in Merceria"; others being that of Camocio (who carried on business "al Segno della Piramide") and Furlani (who appears as engraver, but who also had a shop "al Segno del Nave"). The names appear on some of the maps in association, and from the evidently close relations maintained by Bertelli and Camocio it is possible that the collection was a joint venture of the two. It includes also some maps published at Rome (some by Lafreri), just as the Lafreri collection includes items by Venetian cartographers.

An analogous but smaller collection, hitherto little known to students, is also preserved in Italy—at the Communal Library at Treviso. It contains 73 maps, of which 49 are exactly the same in the two collections, while 9 others differ in small points only. The same paper is used for the marginal strips, and many of the watermarks on the maps themselves are the same too. The Quaritch collection, though containing only 52 maps, is complete in itself, for it embraces a systematic selection of maps of all parts of the world. The watermark No. 56 is found here also, but not often, the commonest being an eight-spoked wheel. Like the Trieste volume it includes Gastaldi's big map of Africa of 1564 (properly in 8 sheets, of which one, embracing part of the Southern Atlantic, is here missing) reproduced by Nordenskiöld in his 'Periplus'; and it also includes a large wall-map of Europe, hitherto virtually

unknown to students, by Giovan Pietro Contarini, in 15 (out of 16) sheets. The only other known copy of this last is in the Biblioteca Alessandrina at Rome.

Prof. Almagià points out that, with the exception of one map dated 1570 in the Trieste volume, none of these three collections contains a map of later date than 1569; he therefore concludes that the Venetian publishers were supplying them to clients in 1569-70. (He notes that certain maps known to have been re-issued in 1572 and 1573 bear here the original dates between 1566 and 1569.) As all the known copies of Lafreri's Atlas with title-page contain maps of after 1570, he is inclined to credit the Venetians with the priority in this sort of enterprise, though he allows that Lafreri may have supplied his customers with miscellaneous sets of maps before the title-page was thought of. It thus would seem that Ortelius was anticipated by his Italian rivals in the idea of issuing such a general collection, though he no doubt surpassed them in his judicious choice of the maps composing it.

In a special note on Gastaldi's unique world-map of 1569, which forms No. 6 of the Trieste collection, Prof. Almagià gives reason to conclude that it is a re-issue by Camocio of an earlier map, now unknown, published before 1562 and referred to in Gastaldi's brochure of that year. As it represents the Strait of Anian, between Asia and America, in precisely the same way as in Zaltieri's often-quoted map of 1566, it is almost certain that, as was suggested by Marinelli (cf. *Journal*, 50, p. 307), that representation was merely copied by Zaltieri from Gastaldi.

Prof. Almagià's list of maps in the Trieste volume gives references throughout to previous lists (by Castellani, Nordenskiöld, Wieder, and Phillips) in which the same maps occur; the Quaritch list refers to the Phillips list (of maps in the Library of Congress Collection) and to that of Nordenskiöld, with occasional references to similar maps in the British Museum. Certain of the maps in the Quaritch list, of which it is there remarked that no other copies had been traced, occur also in the Trieste volume, the description of which had not appeared when the Quaritch list was printed. But its compiler has also overlooked the fact that several of the special rarities, e.g. Gastaldi's big map of Africa, are to be found in the British Museum.

GENERAL

A New Magazine.

The first number of 'Antiquity: a Quarterly Review of Archaeology,' appeared in March last, edited by Mr. O. G. S. Crawford of the Ordnance Survey and published by John Bellows, Gloucester. The annual subscription is £1. The Editorial Notes setting out its aims state that it "will attempt to summarize and criticize the work of those who are recreating the past: . . . our field is the Earth, our range in time a million years or so, our subject the human race." In this wide sphere, there will be scope for the geographer as well as the aviator, astronomer, botanist, and other scientists specifically mentioned in the Notes. The nature of the contents will be made clear by a brief survey. Mr. Crawford gives an account of his examination during low spring tides of stone walls of human construction in the Tresco and Samson flats of the Scilly Islands. Similar prehistoric stone walls are found on the island of Bryher, and their existence points to a land subsidence in recent times, probably gradual, not catastrophic, but nevertheless the basis of the Lyonesse legend. This article is illustrated by air photographs, and the value of these in archaeology is further shown in an account by Mrs. H. E. Cunningham of the discovery of a "wood circle" near Durrington Walls. From the ground

this circle was taken to be a mutilated disc barrow, but aerial photographs and subsequent excavation revealed six concentric circles of holes, which once held posts or trunks, within a wide ditch and bank. Its similarity from the air to Stonehenge led Squadron-Leader Insall, V.C., to photograph it and to draw the attention of archæologists to it. A similar circle has recently been excavated in Holland, at Harendermolen, near Groningen. An article with more geographical interest is contributed by Mr. V. Gordon Childe on "The Danube thoroughfare and the beginnings of civilization in Europe." Before the Alpine passes were open, while much of Central and Northern Europe was covered with forest, the Danube offered a way of penetration for the Ægean civilizations into Central Europe. Its supplies of fish induced explorers to sail up it and to discover the loess deposits suitable for settlement and particularly the mineral wealth of Transylvania, Bohemia, and elsewhere. Research has shown fundamental relationship between these settlers and the people of the Ægean, especially of Troy. In this way, as the loess lands of Moravia, and afterwards of Central Europe generally, were opened up, neolithic culture extended from Galicia to the Rhine valley. When Troy II. flourished, a close connection was maintained with the Middle Danube, and Bohemia may have been one source of tin for alloy. The fall of Troy about 1800 B.C. and the opening of the Brenner led to the isolation of this region, but a local bronze culture (Aunjetitz) flourished in Bohemia and Thuringia.

Among the remaining contributors, Mr. A. P. Trotter, discussing Stonehenge as an astronomical instrument, after analyzing Sir Norman Lockyer's work, concludes that as an instrument for the settling of dates it cannot have been very successful, and that its real purpose is still conjectural; Mr. R. C. Collingwood gives an account of the alterations in position and character of the Roman frontier in Britain; and Mr. R. Firth describes Maori Hill-forts. It will be seen that the contributions are varied, and they all are clearly written.

The Forerunners of Hakluyt.

The sudden burst of activity in many spheres in the Elizabethan Age, almost unheralded in previous decades, has been remarked upon by historians. Mr. G. B. Parks, in a contribution to *Washington University Studies*, vol. 13, seeks to show that in geographical science, likewise, England had shown little interest for years in the deeds or accounts of discovery, and that Hakluyt's great work marked an unprecedented advance in geographical literature. Scholars like Erasmus and Moore had encouraged the study of geography, but as students of the classics rather than of the modern world. Previously Caxton had printed Higden's 'Description of England' and the 'Mirror and Description of the World' of Vincent of Beauvais, but their practical value was not great, as might be said also of Mandeville. Later, the Spaniard, Vives, who came to England as tutor to Princess Mary, recommended the study of the amended maps of Ptolemy. Here, as elsewhere, the impetus was foreign. In actual navigation and discovery much was owed to the Cabots, for example, and to the works of Verrazzano and Roze. One English writer, John Rastell, however, showed a less superficial interest in geography, and his 'Interlude of the Four Elements,' a curious outcome of an abortive expedition to Newfoundland about 1516, added to the general knowledge of the new world. But the turning-point came with the founding of the Russia Company in 1555, which again owed much to Sebastian Cabot. Knowledge of navigation and of distant countries was now greatly desired, and a translation of Cortes'

'Art of Navigation,' and Cunningham's 'Cosmographical Glasse' appear on the one hand, and on the other Eden's 'Decades of the New World,' a compilation from Peter Martyr with additions. Mr. Parks concludes with a list of English books on geography prior to Hakluyt, which shows the superiority of the latter's work, though it too was largely a compilation from foreign sources. Here, also, the scientist was meeting the demands of the practical man, rather than directing his further course.

OBITUARY

Dr. Walter Leaf

GEOGRAPHICAL interests and distinctions were by no means the only ones, or indeed the chief, that Dr. Walter Leaf could claim. He was by predilection and training an exact scholar, with a fine taste for beauties of literary style, as he showed so long ago as 1882 by his collaboration with Andrew Lang and E. Myers in a famous version of the 'Iliad,' and more lately by his 'Little Poems from the Greek.' By adoption and application he became so good a man of business as to be chosen to fill the parts of Chairman of the Committee of the London Clearing Banks, President of the Institute of Bankers, and Chairman of the Westminster Bank; and it was this business qualification as much as the scientific that commended him, after having been a member of this Society since 1898, for election to the Council in 1924. But his study of a particular province of ancient geography, to which he was led by early Homeric studies, was most congenial and thorough-going, and promised to lead him into wider fields than the Troad before the War nullified his project of producing, with a body of collaborators, the long-desired edition of the whole text of Strabo with geographical commentary. He was not deterred, however, from continuing his own special studies and putting out their results in his 'Homer and History' (1915) and 'Strabo on the Troad' (1923). Into these books he may be said to have collected all about the north-west corner of Asia Minor that the future editor of Strabo will need to know. Of other services to science and letters and to archæology (particularly to Hellenic studies) and scholarship, it can only be said here that they were far greater than are represented by his literary output. Few scholars during the past forty years have not owed something to his acumen, learning, and encouragement; while of his generous help to the causes and individuals that interested him, ten times more could be written than he would ever have wished made public. A man of strong preferences and some prejudices, and now and then ungracious in controversy, he responded readily to genuine enthusiasm, and always allowed the public interest to overcome in the long run any personal feeling. His combination of capacities and of qualifications will not easily be repeated.

D. G. H.

Dr. Charles Doolittle Walcott

We record with deep regret the death, on February 8 last, of Dr. C. D. Walcott, Secretary of the Smithsonian Institution, and an Honorary Corresponding Member of the Society since 1916. Dr. Walcott was born in Oneida County in 1850, a descendant of seventeenth-century immigrants from Shropshire. His interest in geology and fossils was early aroused, though it was not until he was twenty-six that he was able to devote himself entirely to

scientific research. His first post was assistant to Prof. James Hall, then, in 1876, State Geologist of New York. Three years later he entered the United States Geological Survey, beginning work in southern Utah and Colorado, and later investigating the Palæozoic rocks of Central Nevada. He also undertook in addition the identification of the Palæozoic fossils in the Museum at Washington. He was Director of the Survey from 1894 until 1907, when he was elected secretary of the Smithsonian Institution. In both these offices he displayed much administrative ability without neglecting his scientific studies. As Director of the Survey he had also evinced a far-sighted and fruitful interest in the development of forestry and reclamation. His greatest achievement was the finding of impressions of soft-bodied organisms, primitive crustaceans and the like, in the Algonkian and Cambrian formations, a considerable addition to the knowledge of the dawn of life on the Earth. Amongst many academic distinctions, Dr. Walcott was President of the National Academy of Sciences from 1917 to 1923, a foreign member of the Geological Society of London (from which he received the Bigsby and Wollaston Medals), and a Corresponding Member of the Academy of Sciences, Paris.

CORRESPONDENCE

Mawenzi

MAY I take the liberty of correcting a mistake which appears in Mr. Gilman's note on Dr. Latham's article in the December number of the *Geographical Journal* on page 505? It is there stated that G. Londt climbed Mawenzi in 1925, and from the context it might be assumed that this ascent was a complete ascent to the highest point. This is not correct. Mr. Gilman has unfortunately been misled by the newspaper reports of Londt's climb. Londt, in an official statement to this club, does not claim to have climbed Mawenzi itself, but only a minor peak thereof. Reference may be made to the November number of the *Alpine Journal*, page 345, where a correct statement of Londt's climbs appears.

KEPPEL H. BARNARD,
Hon. Secretary.

The Mountain Club of South Africa,
Capetown.

From Burma to Assam by the Kronjong Pass

I HAVE just seen in the *Geographical Journal* for March that Mr. F. K. Ward has done me the honour to criticize the brief account of my journey which appeared in the *Journal* of last July. The letter from which this account was extracted, was written hurriedly on the train without any idea that it would be published, and still less that it would be subjected to meticulous comment. Mr. Ward infers that a path *does* exist up the Nam Yin and the Nam Kampi and that it "is used regularly by the Mishmis, . . . to fish in the headwaters of the Mali Hka." Although a path did exist up the Nam Yin to a point about 2 miles above the junction of the Nam Kampi and the Nam Kamyang, it went from the now non-existent village of Nam Kabat and was kept open by the Shans. It has not been used for many years and at present no trace whatever remains of it, and it is necessary to use the bouldery bed of the torrential stream where possible, and where not, to cut a way through

the tangled jungle. It is quite common knowledge in and about Hkamti that the Kronjong Pass was used for generations, partly by the Mishmis but chiefly by the Shans. This is now however largely a tradition, as the route (not *path*) has long been abandoned, first because the Shans who kept it open, now go *via* Myitkyina and Mogaung and the Hukawng Valley; and secondly because the musk-deer, which was the Mishmis' object rather than fishing, has become scarcer. The Shans of the Nam Kiu monopolize the fishing, and there are no fish in the Nam Kampi and none in the Nam Yin above the Longlin pool, some 3 miles above the Mali Hka. To indicate the nature of the "going" by the Kronjong route I may say that, on dismissing my carriers in Assam, not one of the twenty, comprising four different tribes having no interests in common, elected to return by that way. All took much longer but easier roads.

Mr. Ward's opinion that my difficulties were due to the season and an unusually wet spring is incorrect. Though from 15 March to 9 April 1926 there was, I believe, a wet spell in the region round Sumpurabum, far to the south, I think I am correct in saying that the records kept by Dr. Pardee in Fort Hertz show nothing abnormal in the weather at Hkamti during that period, and during the last week before I left for the pass we hardly had a single drop of rain. Before we reached the upper Kampi, though we had almost daily showers and mist *en route*, the snow had entirely disappeared from the south-east side of the pass. As a matter of fact, these steep mountain streams vary diurnally rather than seasonally, except of course where there is much snow, and the time of year chosen for my journey, *i.e.* between the melting of the last snows and the coming of the wet season, was, as every one in those parts realizes, the most favourable for such a journey. In any event it was the *only* time at which it would have been possible to secure coolies who would face it.

Now as to the interesting subject of the Ghalum and the Zayul Chu (let us drop the name "Krawnaon," as it is one little if ever used in referring to this river). So very few Europeans have seen the junction that exact information would have been of more interest than the mere remark that my statement that the Zayul has not so very much more water in it than the Ghalum was "astonishing." There is, of course, no question as to which of the two rivers is the *chief* source of the Lohit; this has long been established in favour of the Zayul, not only on account of its much greater length, but because of its predominance in volume throughout the bulk of the year. The Zayul Chu has an approximate length from source to its junction with the Ghalum of 100 miles, in which, or in at least 95 miles of which, it drops at the utmost 7000 feet, an average grade of 70 feet per mile. The Ghalum in its much shorter course, probably not over 30 miles, falls some 12,000 feet or 400 feet to the mile. In its last 15 miles above the junction, the Zayul has a grade of only about 30 feet to the mile, while in the same distance the Ghalum's gradient is 200 feet per mile, or nearly seven times as great as the Zayul! This latter figure is from my own instrumental observations. Moreover, for nearly the upper quarter of its length the Ghalum actually lies amid huge and almost inexhaustible snow-fields, and the period when the extreme gradient of this river would so largely assist in augmenting its contribution would be when these fields were melting and providing unlimited supplies of water at its source. It was at this precise moment that I traversed the river and that I photographed its junction with the Zayul Chu. My own careful observation was that in April there was little difference in width, though possibly the depth of the Zayul was greater, but allowing for the much greater speed of the Ghalum, my remarks were, I consider, entirely justified. The aspect of these two rivers might be changed in

winter, with the sources of the Ghalum frostbound, and its steep gradient of little use, while the Zayul, flowing throughout its greater length in comparatively low altitudes, would continue to discharge more nearly its usual volume. The comparatively wider valley of the Ghalum and the Lohit (called in its upper part the Tellu) are obviously, at this point, geologically one, and clearly carry the same river without change in course, while the Zayul enters through a much steeper and narrower gorge (probably of more recent origin) and at almost exactly right angles to the combined Ghalum and Tellu.

And finally, to take up his first criticism last. A full half-page has been devoted to my statement that I found the Mishmis (I refer to the Mijus and Taroans, not to the Digaru Mishmis, as he assumes) quite manly, reasonably friendly, and hospitable, contrary to certain previous reports. My reference was not to the accounts of any of the people he mentions, but to another expedition in which, in my humble opinion, sufficient consideration was not given to the wretched conditions under which these poor people exist, in the strictures made against them.

D'ARCY WEATHERBE.

Peking, 29 March 1927.

Mr. F. Kingdon Ward writes in reply :

In 1922-23 a number of Mishmis came over the Krongjong Pass, and I met them fishing in the Nam Yin, and bought fish from them. I was told that they came every year, but perhaps they have now ceased to come.

No doubt the Ghalum, as Mr. Weatherbe says, in spring does at first sight look nearly as large as the Zayul Chu ; but it did not seem appreciably to increase the volume of water in the main stream in December. But is it not somewhat strange that this Ghalum, with its "unlimited supplies of water," its immense descent, and its assumed greater age, has not worked nearer to the base level of erosion ?

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1926-1927

Twelfth Evening Meeting, 2 May 1927.—The President in the Chair.

ELECTIONS.—Mrs. Vera Jean Hamilton Antoniadi; The Ven. Archdeacon Francis Bertie Boyce; Lieut. Alan Vincent Gandar Dower; Miss Cecilia Phyllis Goodenough; Ernest Tooke Jameson, M.D.; Charles Matthew; The Rev. Euston John Nurse, M.A.; Humphrey Pease; Hugh Handley Pegg; Hjortur Chester Thordarson; Ph. C. Visser; Basil Patteson Walker-Taylor.

PAPER: Ladakh. Col. R. Meinertzhagen.

Seventh Afternoon Meeting, 9 May 1927.—Sir Charles Close, K.B.E. (Vice-President), in the Chair.

PAPER: The Stereoscopic Survey of the Shaksgam. Major K. Mason, M.C., R.E.

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